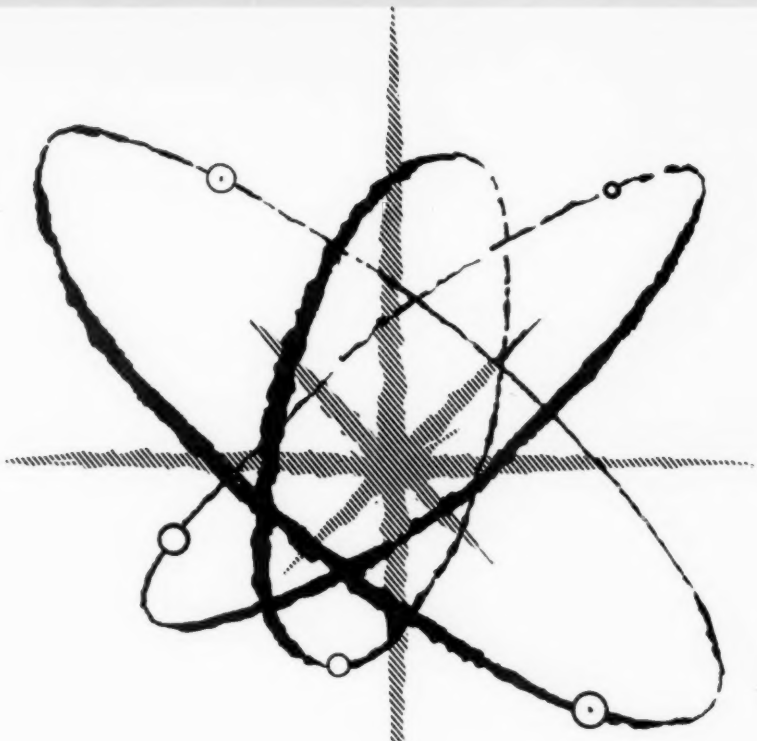
JULY 1959
VOL. 21 NO. 8

MINING WORLD



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Also:

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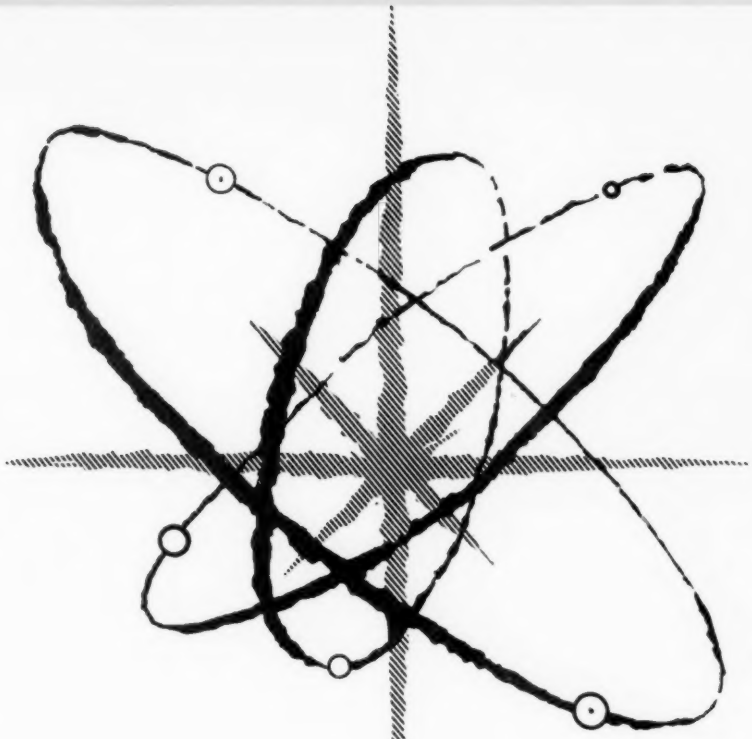

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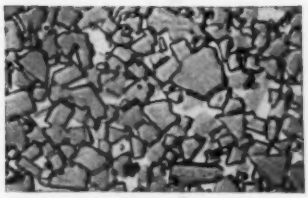

Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.

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	F		x	x														
	113		x															
	H			x	x	x	x	x		x								
	115			x	x													
	D						x	x	x	x	x	x	x	x				
	K													x	x	x	x	
BOTTOMING	1" Rope				x	x	x	x		x								
	1¼" Rope						x	x	x	x		x		x				
	400						x	x		x		x						
	1½" Rope											x	x	x	x	x		
	600											x	x	x	x			
	700													x	x			
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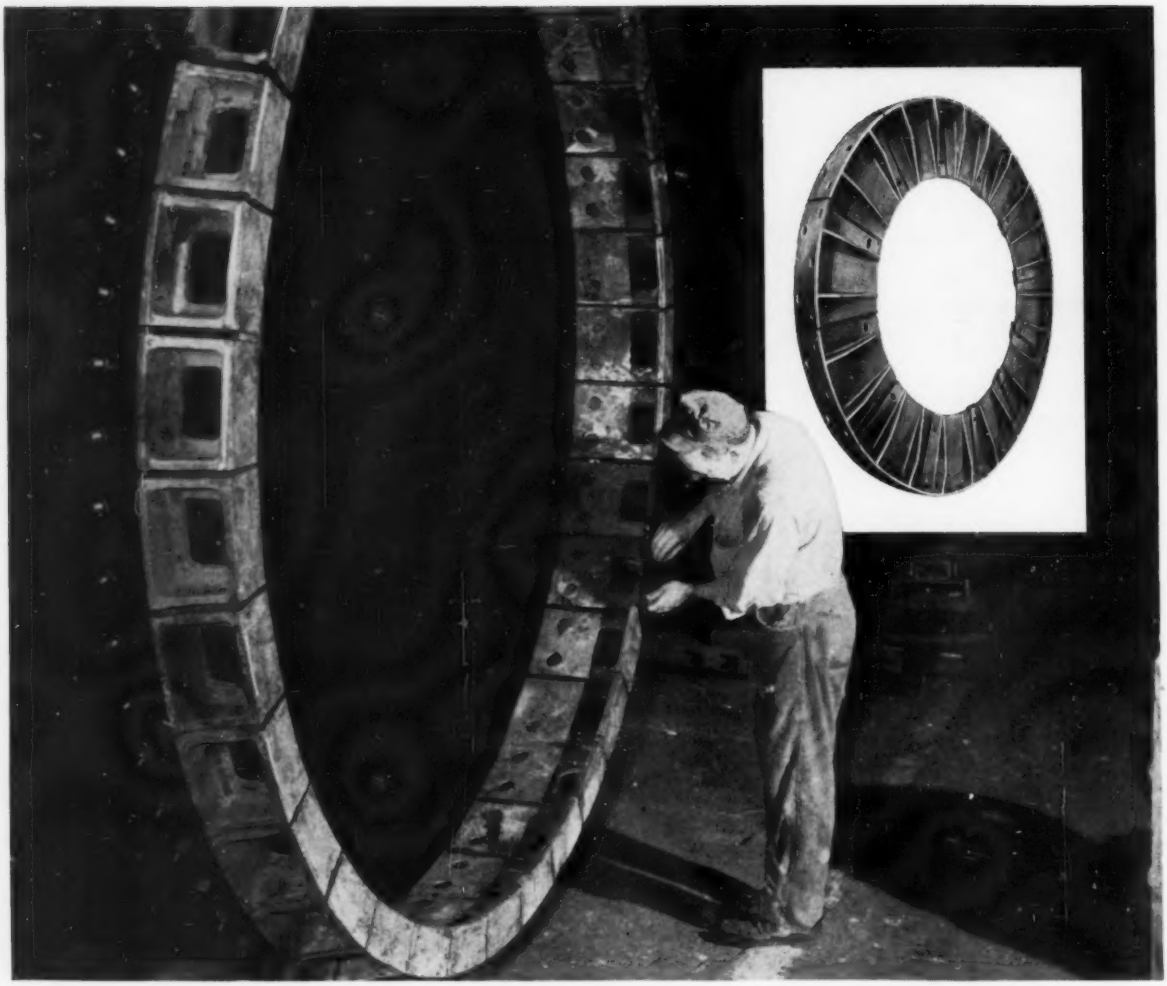

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Spare part inventory may be kept low because the same nose ring castings may be used on kilns varying up to 4 feet in diameter, depending upon size. Write for Bulletin S-17. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

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BOILER DIVISION

S-467

Mining World

Including the Export Edition **WORLD MINING**

VOLUME 21 **JULY 1959** No. 8

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How Nuclear Explosions Can Be Used For Mining 31

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How Canada's Elliott Lake Mines Mechanize For Low Costs ... 39

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A New Reagent Combination Floats Chrysocolla 44

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MILLER FREEMAN PUBLICATIONS

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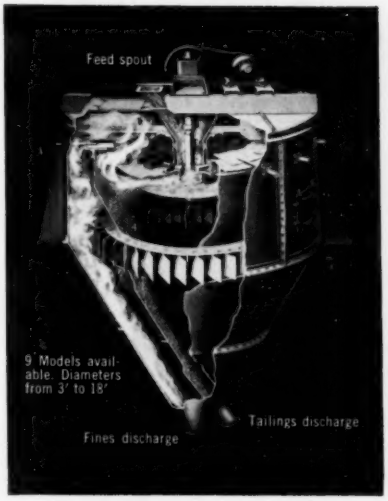

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MINING WORLD, July, 1959. Volume 21, No. 8. Published monthly except April, when publication is semi-monthly at Emmett St., Bristol, Conn. Executive, advertising and editorial offices, 500 Howard Street, San Francisco 5, California. Subscription in United States, North, Central, and South America, $4.00 per year; other countries, $5.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Bristol, Conn., under act of March 3, 1879. Postmaster: please send notice 3579 to MINING WORLD, 500 Howard Street, San Francisco 5, Calif.

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500 Howard Street
San Francisco 5, California
EXbrook 7-1881

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Published by American Trade Journals, Inc.
Wm. B. Freeman, President
L. K. Smith, Vice President
Miller Freeman, Jr., Sec.-Treas.

SUBSCRIPTION RATES:
U.S., North, South and Central America $4.00
Other Countries $5.00
Single Copies .....$ .50
Directory Number $1.00

CHANGE OF ADDRESS:
Send subscription orders and changes of address to MINING WORLD, 500 Howard St., San Francisco 5, Calif. Include both old and new addresses and zone numbers.

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MILLER FREEMAN PUBLICATIONS

Drifts and Crosscuts

Share Your Ideas To Cut Costs

The need to cut costs to stay in business was never more mandatory than today. Competition is keen between companies producing the same metals and between individual metals for their share of markets.

Foreign competition has already given the lead and zinc producers many headaches and recent announcements by the major steel companies show how much foreign wire, nails, and rebars have displaced their normal domestic sales. The big reason foreign companies can sell in the United States is lower costs.

The most attractive market in all the world for metals will continue to be the United States because the economy is a metal economy and sound money, or what it will buy, is available for payment. Foreign uses of metal are expanding and will accelerate too, but that won't stem the desire to sell for dollars.

On many occasions A. E. Millar, general manager of Anaconda Company's Yerington mine and the Editor have discussed advancing technology thus permitting cost cutting in the mineral industry. Mr. Millar has supplied detailed information for several years on how Anaconda cuts blasting costs. In this issue another Yerington cost cutting method, surfacing mine haulage roads, is described by Donald K. Gill, general mine foreman and chief engineer.

Mr. Millar and the Editor invite your comments and ideas on how new developments are saving money at your mine. Send them to MINING WORLD.

Prospector-Rancher Cooperation

A real attempt is being made by the Three Bells Mining and Milling Company, Inc. of Lordsburg, New Mexico to cooperate and get along with the local ranchers and holders of grazing rights.

The company president, Leslie J. Reagan, has prepared a code of ethics for his mine and mill employees, as well as his mineral survey crews. This code is based on the fact that both the prospectors and the ranchers have rights, and that understanding of the rights and their inherent responsibilities goes a long way toward friendly cooperation.

The codes, in brief, require closing of all gates, respect for fences, care in preventing fires, preservation of natural range, and doing nothing to harm the livestock.

The plan is a good one. Federal and state withdrawals, regulations, and specific marking of lands have drastically cut back the area open to prospect.

If all prospectors followed this program, there would be less reason for additional withdrawals.

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MINING WORLD NEWSLETTER

July 1959

OUT OF DOMESTIC URANIUM BY 1970 . . . is the surprising report of Harris, Upham & Co.'s Science and Securities May 1959 issue. In forecasting growth of uranium industry this predicted shortage will come at time when demand for nuclear reactor fuel will be climbing sharply. It will take 28,700,000 tons of ore to supply the uranium metal needed in 1970. Miners laugh at the "out of ore" thought and say give us a chance, look what we did in last 10 years.

VAST AFRICAN EXPLORATION PROJECT . . . will cover 40,000 acres of Bechuanaland under agreement made by Bamangwato Tribal Authority and Rhodesian Selection Trust Exploration Limited. This area between Southern Rhodesia and Union of South Africa has never been prospected.

PALO VERDE, ARIZONA'S NEWEST . . . copper mine should be in production in 18 months as Banner Mining Company sinks new five-compartment shaft to develop high-grade Eisenhower ore discovered by drilling near its Daisy mine.

ANOTHER FLORIDA PHOSPHATE MINE . . . may be the object of Kentucky Store and Land Company which paid about $8,500,000 for 2,700 acres between Bartow and Fort Meade in the Bone Valley phosphate district.

COLUMBIUM PLACERING IN NEW MEXICO . . . is the reported goal of a large dredging company which has been test drilling creek bottoms and benches in northern part of state.

UNION MINIÈRE SETS COPPER GOAL . . . at an all-time high of 260,000 metric tons in 1959. Mines in Belgian Congo are operating at capacity to exceed previous high of 235,596 tons in 1956.

FIFTH WYOMING U_3O_8 MILL CONTRACT . . . has been signed by Globe Mining Company and AEC. Globe is subsidiary of Union Carbide Nuclear Company and controls large reserves in East Gas Hills.

LEAD CONCENTRATE STOCKPILING . . . is underway at Broken Hill, Australia to keep metal off world markets. Both North and South Broken Hill companies had previously cut mine output. At South mine important ore discoveries have been made on western flank of anticline.

MINERALIZED SHEAR ZONES . . . have yielded much of Idaho's mineral production. Now, Idaho Bureau of Mines and Geology studies shears to try and develop guides for mineral exploration.

ATLANTIC CITY TACONITE MILL . . . gets closer. Wyoming reports indicate United States Steel Corporation asked for bid proposals for initial rock work and mill construction. Detailed engineering has been virtually finished by San Francisco, California mill designers. All it takes now is approval of funds to get this major project rolling.

HOWARD YOUNG SEES HIGHER ZINC PRICE . . . with normal average price of slab zinc from 12 1/2 to 13 1/2 cents per pound after present over supply difficulties are corrected.

ANACONDA ALUMINUM UPS OUTPUT . . . to meet improved sales outlook and improved demand as economic conditions in the aluminum industry get better. Alcoa, Reynolds, and Kaiser have all increased production recently.

MORE IRON FROM BRAZIL . . . is purpose of $12,500,000 loan from Export-Import Bank of Washington. Cia Vale do Rio Doce will double production to 6,000,000 annual tons with loan funds. Railroad, port, and mining equipment will be purchased in United States.

32,500,000 TONS OF COPPER . . . are estimated as United States' reserves by government geologists. All is mineable at 1958 cost-price level. Exploration finds more everyday, too.

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Treasury Gives No Hope For Gold Miner

Practically all economists have expressed concern over the United States Treasury's gold situation and the outflow of gold to foreign nations as they, increasingly alarmed at the dollar depreciation, are demanding gold for their dollar balances. In other words, the dollar which has migrated abroad has 100 percent gold coverage while the dollar (except for silver certificates which are covered 100 percent) needs only a legal gold reserve of 25 percent back of it. Everybody seems to be worried except Secretary of the Treasury Anderson and his staff.

Gold left the Treasury at the rate of $2,300,000,000 last year and it is difficult to know how much will flow out this year. At any rate, from $24,600,000,000 in 1949 the gold stock now is down to less than $20,200,000,000. After deduction of all outstanding obligations to date, and the necessary gold cover of the currency of about $11,-700,000,000, the Treasury will have only about $8,500,-000,000 of gold which is not obligated in some fashion. At the 1958 rate of outgo, if it should continue, the Treasury before long will be scratching hard to meet the legal reserve requirement.

Worried by this situation and also by the condition of the United States gold mining industry, a number of Representatives and Senators and their staffs had a meeting with Secretary Anderson and members of his staff to discuss Treasury policy and pending gold legislation.

Although the meeting was confidential, some of the Congressmen present have seen fit to make public certain of the Treasury policy statements which account for the Administration's adverse attitude toward all gold legislation introduced into the Congress over a period of years. Among these are the following:

1. The Secretary stated that the gold reserve is safely above the legal reserve requirement of 25 percent.

2. The Secretary does not favor subsidies of any kind, including a subsidy which would restore the domestic gold mining industry.

3. He has no intention of advocating an increase in the price of gold as this would be inflationary and would shake the faith of the world in United States money which, apparently, is the rock upon which foreign currencies and foreign trade is built.

4. Creating a free market for gold might lower rather than raise the world price of gold. (No reason was given for this statement apparently, or if so, it was not quoted.)

5. Prohibiting the Treasury from selling gold to industry, and creating a domestic free market only, would cause a shortage of domestic industrial gold and result in a two-price system—of which the Treasury does not approve.

6. Convertibility. If the Treasury has no intention of changing the monetary value of gold there is no reason why the United States citizen should not hold gold as freely as the foreigner who can convert his gold to dollars. The Congressmen who were present at the Anderson conference say that this question was not answered by the Treasury experts.

7. As far as a subsidy for domestic gold production is concerned, the statement is said to have been made that such a move create uneasiness in the world financial markets since it might be construed as a preliminary move prior to a change in the gold price. Also, the Treasury has calculated that the increase in gold production would be only around $35,000,000 per year, an amount not worth bothering about.

As is common knowledge, the State Department is hand-in-glove with the Treasury in these monetary matters. The Bureau of the Budget and the White House generally will go along with these agencies and the respective Banking and Currency Committees of both Houses of the Congress are so impressed that no action can be had on gold bills.

Weed Offers Sensible Copper Plan

The proposal of Clyde E. Weed, chairman of Anaconda Company, that the government sell copper when the price exceeds 35 cents per pound would certainly have a stabilizing effect upon domestic and world prices. As copper often fluctuates upward sharply during periods of labor troubles, the suggestion might have a slight element of strikebreaking in it. At any rate, it certainly is more sensible than the tactics of the British Ministry of Supply, which always seems to sell when markets are weak, or the proposal of OCDM that a certain number of tons per month be sold regardless of price. Also the government would realize a reasonable return on its surplus stocks.

OCDM Would Sell—Agriculture Would Buy

While various statements have been made by the Office of Civil and Defense Mobilization that the defense stockpiles of metallurgical manganese are in considerable surplus, the Department of Agriculture recently added metallurgical manganese to the barter list. On the one hand we want to dispose of stockpile "surpluses" while on the other hand we add to the supplemental barter stockpiles. Doesn't make much sense!

Mineral And Ore Permits Predominate

According to the Department of Commerce, which controls licenses to trade with Iron Curtain countries, the bulk of present certificates consists of mineral and ore permits. Look for this trend to increase as time goes on and more attempts are made to placate the U.S.S.R.

Mineral Policy Hearings

Representative Wayne Aspinall of Colorado, chairman of the House Interior and Insular Affairs Committee, opened on June 25 a series of hearings designed to determine government mineral policies (if any) in all fields. These hearings were based upon Aspinall's bill H. Con. Res. 177. Whether this move will have any effect upon the Administration's minerals policy remains to be seen. It may have some effect upon the Congress, since the whole matter will have a thorough airing with all the agencies which have anything to do with mining being questioned.

Now It Is Potash!

The latest indication of increased trade with Russia is the rumor that the United States may permit the sale of Russian potash here.

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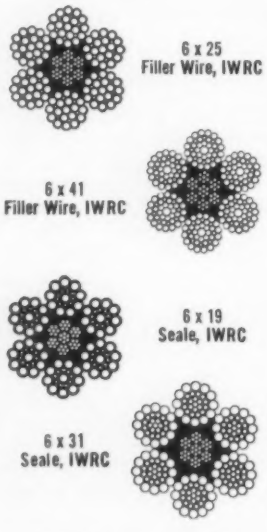

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6 cu. yd. P&H Model 1600 Electric digging frozen hardpan.

NOW the EUCLID "TWIN" Scraper has EVEN MORE POWER* and WORK-ABILITY!

*Now 563 total h.p.!

No other scraper gives you all the features you get in the TS-24 "Euc"

- 2 engines— 563 total h.p.
- 2 Torqmatic Drives
- No spin differentials
- All-wheel drive
- 32 yds. heaped (24 yds. struck)
- 27.00x33 tires (33.5x33 optional)

Euclid's TS-24 Scraper, with power increased to 563 h.p., now widens its lead in performance over every other scraper in the field. With a 336 h.p. engine in the tractor and 227 h.p. at the rear, this "Twin" is unsurpassed in productive capacity.

On job after job—small grading work to big yardage projects—the TS-24 Twin-Power "Euc" moves dirt at lower cost than other scrapers.

Its big power, big capacity and big performance has helped contractors, mines, quarries and industrial users to beat the pinch on profits.

Have a Euclid dealer show you how the "Twin" can bring a better return on investment . . . on your present or future work. He'll give you all the facts and can probably arrange a demonstration for you.

EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

IN MINNESOTA IRON MINES
6 cu. yd. P&H Model 1600 Electric digging frozen hardpan.

FROM THE MEXICAN TO CANADIAN

IN ARIZONA COPPER MINES
8 cu. yd. P&H Model 1800 Electric digging conglomerate cemented gravel.

BORDER

One P&H sells another because

P&H "PROFIT·TONS" reduce loading costs... even in hardest digging

Up to 30% higher bail pull—faster swing—exceptional physical strength of P&H welded construction—greater job availability all add up to as much as 10% more production, lower loading cost per ton and *more net profit* for owners of P&H Electric Mining Excavators on their hardest digging assignments.

P&H "Profit-Tons" are the end product of these *exclusive* P&H design principles:

MAGNETORQUE* . . . the most productive digging motion drive known for electric excavators. This *patented* P&H drive electro-magnetically transmits full digging power from an A. C. hoist motor direct to the dipper without motor generator set conversion to D.C. current. It gives higher bail pull, better dipper fill factor and automatic impact protection to the digging machinery.

ELECTRONIC CONTROL . . . the most responsive control for electric excavators. This *patented* P&H control accomplishes the quickest work motion reaction time and gives the greatest cycle productivity known.

In addition, with P&H—and only with P&H—do you get the service assurance of single source responsibility. P&H manufactures their own electrical as well as mechanical components—*designed specifically for electric excavator service.* Write Dept. 556, Harnischfeger Corporation Milwaukee 46, Wisconsin.

P&H LINE:

Electric Excavators:	3½ through 10 yds.
Diesel Excavators:	¼ through 3½ yds.
Truck Cranes:	10 through 80 tons

75 YEARS OF P&H SERVICE

P&H MINING EXCAVATORS

HARNISCHFEGER CORPORATION
Construction & Mining Division
Milwaukee 46, Wisconsin

in IR heavy-duty

compressors

these EXTRA-VALUE FEATURES mean top performance and economy

FULL-FLOATING ALUMINUM BEARINGS

Roll with the punch of each stroke to distribute load

SEALED FRAME

Keeps dirt out • Keeps oil in
Keeps wear down

AIR-CUSHIONED CHANNEL VALVES

Highest efficiency • Exceptionc durability • Quiet operation

FULL FORCE-FEED LUBRICATION

Filtered oil under pressure to all bearing surfaces

take CHANNEL VALVES for example...

exclusive air-cushioned action means long life, high efficiency and quiet operation

The air-cushioned I-R Channel Valve is the greatest advance ever made in compressor valving, and is entirely different in principle and design. No other valve can approach its efficiency, quietness and almost unbelievable durability. The Channel Valve has eliminated the major problem of impact, without using heavy parts which kill efficiency or frail elements which soon break or wear out.

The Channel Valve is actually a combination of several small valves — each channel with its bowed leaf spring operates individually over a corresponding slot-shaped port. The channel lifts straight up in the guides without flexing; opening is uniform over the full length of the port, giving uniform air velocity without turbulence. The cushioning takes effect when a small volume of air is trapped between the channel and its leaf, causing the channel to float silently to a stop.

Channel Valves are a product of Ingersoll-Rand's own valve research and manufacturing departments, and constitute only one of the quality features which have given the I-R compressor line its reputation for excellence. For more information about compressors for any service, from ½ to 7500 hp, call your I-R representative.

ESH
20 to 150 hp.

PHE
75 and 100 hp.

XLE
125 to 350 hp.

PRE
400 to 2000 hp.

XPV
(Steam-driven)
200 to 1500 hp.

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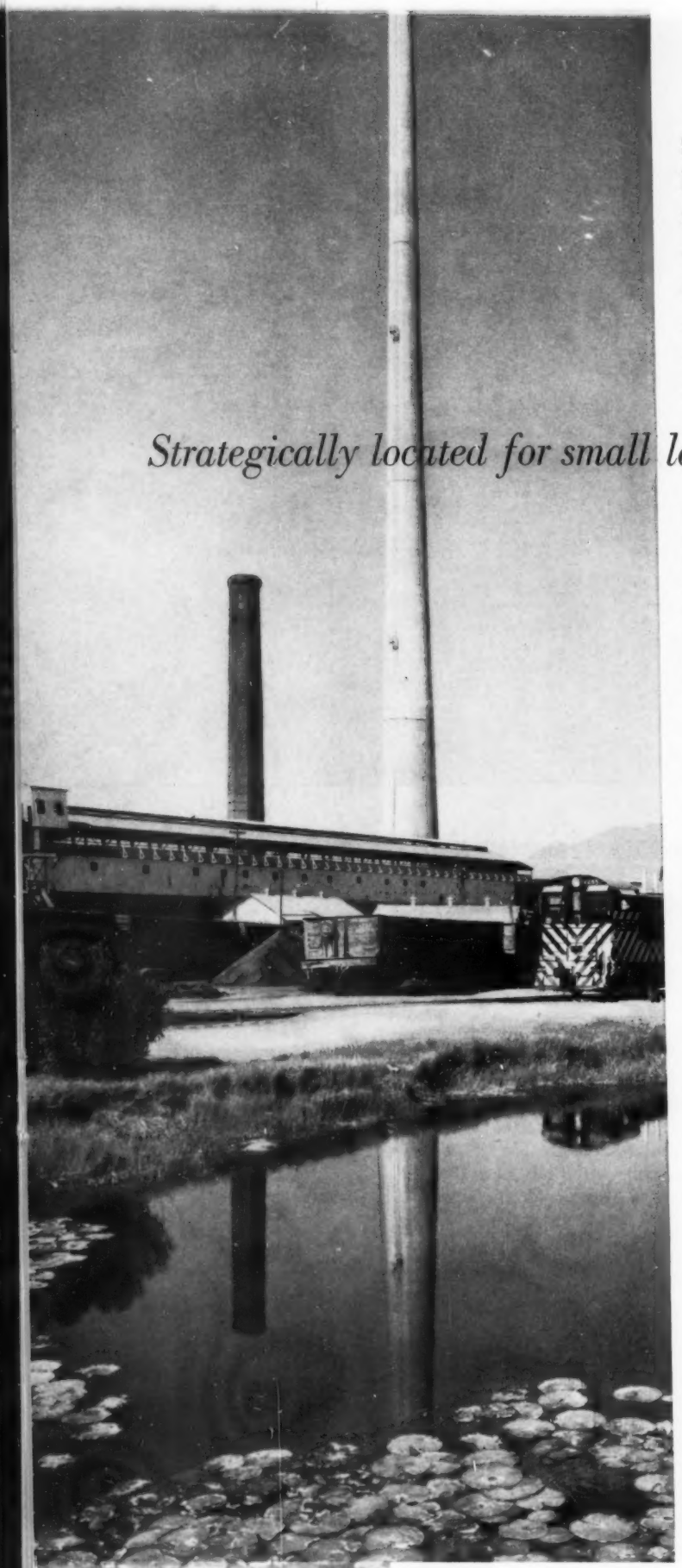

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buying, smelting, and
refining all types of ores:
GOLD, SILVER, LEAD,
COPPER AND ZINC ores
and concentrates, blister
copper, mattes and residues
21 Smelters and Refineries

Strategically located for small lots or carload quantities...

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Leadville, Colorado
Alton, Illinois
East Helena, Montana
El Paso, Texas
Chihuahua, Chih., Mexico
San Luis Potosi, S.L.P., Mexico

ZINC SMELTERS
Amarillo, Texas
Corpus Christi, Texas
Rosita, Coah., Mexico

COPPER SMELTERS
Hayden, Arizona
El Paso, Texas
Tacoma, Washington
San Luis Potosi, S.L.P., Mexico

LEAD REFINERIES
Selby, California
Omaha, Nebraska
Perth Amboy, New Jersey
Monterey, N.L., Mexico

COPPER REFINERIES
Baltimore, Maryland
Perth Amboy, New Jersey
Tacoma, Washington

See management
at above locations
or write to main office.
American Smelting and
Refining Company,
Ore Purchasing Department,
120 Broadway,
New York 5, N. Y.

58-54

ASARCO

This No. 12 has to be dependable because "if the trucks can't move, the mine can't operate"

The Cat No. 12 Motor Grader, maintaining a strip mine haul road in Kingwood, W. Va., is a key machine.

"Keeping the haul road open for 14 to 27 trucks to move 1,000 tons of coal a day is vital. If the trucks can't move, the mine can't operate," explains C. G. Robertson, vice president of the Kingwood Mining Company. "The reason we use a Caterpillar machine is there is less down time and it's economical to operate."

This No. 12 operates the year around, 96 hours a week. It works over the 3½-mile haul road in just four hours. Other times it is used for clean-up work.

There are a number of reasons for its high production and dependability. Operators have good visibility. The mechanical controls they operate offer positive action, make blade adjustments precise. And now the all-transistor Preco Automatic Blade Control is available. It controls blade slope to an accuracy of ⅛ of an inch in 10 feet regardless of position of the grader or the unevenness of the terrain.

Another exclusive is the oil clutch which provides up to 2,000 hours without adjustment.

The 115 HP No. 12 is just one of a family of Caterpillar Motor Graders designed to do more work at lower cost with less down time than any other units in their class. There is also the 75 HP No. 112 and the big, new 150 HP turbocharged No. 14—the most versatile big grader ever developed.

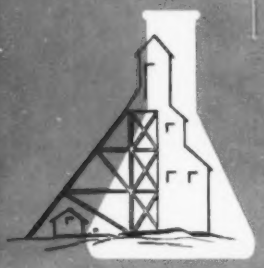
If you have a job that can't afford excessive down time, see your Caterpillar Dealer. Ask to see the Cat Motor Grader that best fits your needs.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

LESS DOWN TIME, MORE PRODUCTION... CAT MOTOR GRADERS



CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

for metallurgists and mill men

Mineral Dressing Notes No. 24

COLOR MICROSCOPY FOR THE MILL MAN

Color microscopy can be an invaluable preliminary to reagent test work by revealing the degree of locking, dissemination, oxidation, tarnish, coating of an ore, etc.

Mineral Dressing Notes No. 24 pictures and describes quick, easy techniques for mounting, polishing and examining samples of mill products, minerals and ores. Using full-color photomicrographs of South American mill samples, this informative publication shows interesting and unsuspected mineral combinations revealed by the microscope and discusses the metallurgical problems and solutions involved.

An automatic counting and recording device built by the author, E. P. Cadwell, to determine the mineral make up of briquetted and polished samples is described in detail.

This new issue of Cyanamid Mineral Dressing Notes will be a valuable addition to your technical reference bookshelf. Send for your copy to our nearest office or to New York.

Please send copy of Mineral Dressing Notes No. 24, without cost or obligation.

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EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
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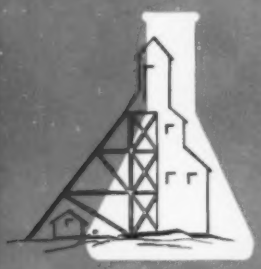

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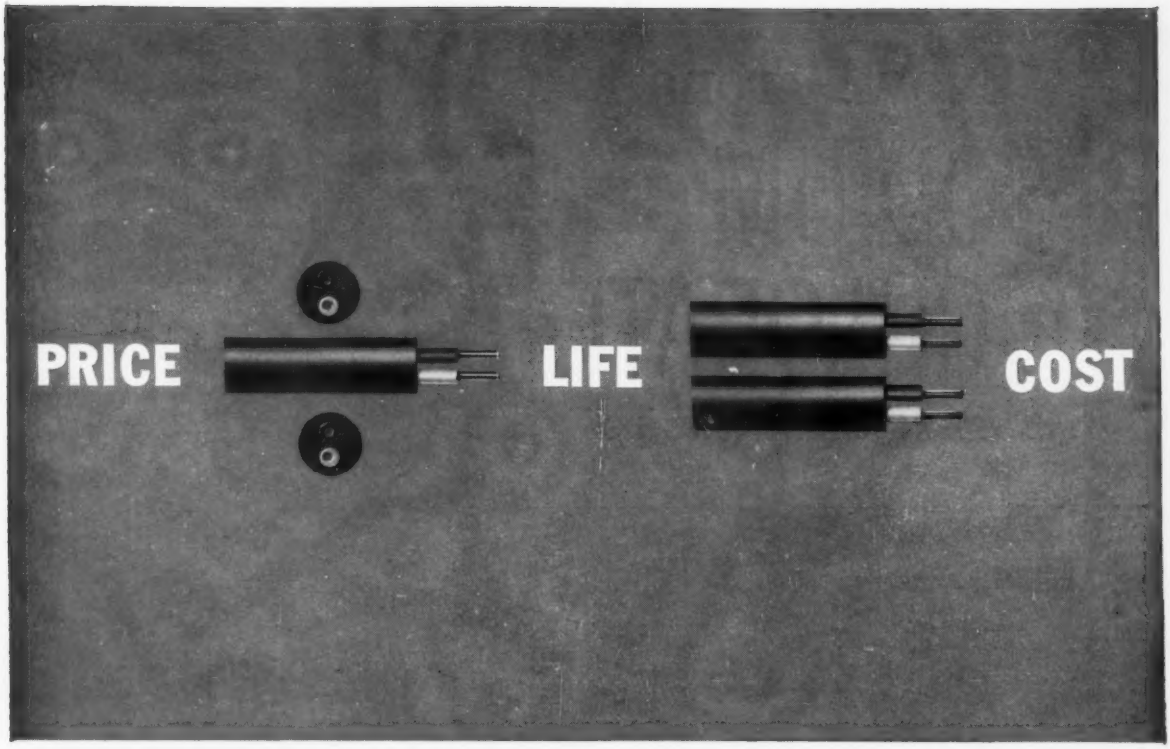


Tirex ...A Case of Symbol Arithmetic

True economy cannot be measured by initial price alone. In buying cords and cables, for instance, the products with lowest prices could well be very expensive in the long run.

Your proper index of value is consistently excellent performance over a long period of time, regardless of the most severe operating conditions.

On this basis, your logical choice is SIMPLEX TIREX. Tirex neoprene-armored cords and cables are made by the original Simplex "cured-in-lead" process. Tough, flexible, and long-lived, Tirex gives you genuine economy by giving you complete dependability.

Write for your copy of the Simplex Tirex cord or cable catalog, which contains complete information, including specifications and application data.

"Built like the finest, toughest automobile tires"

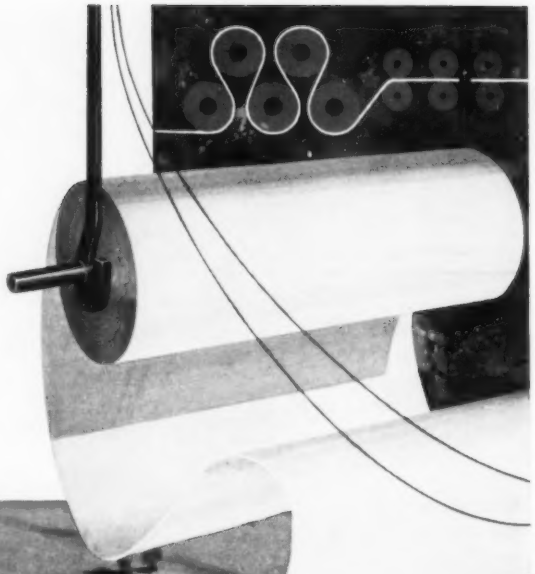
Simplex

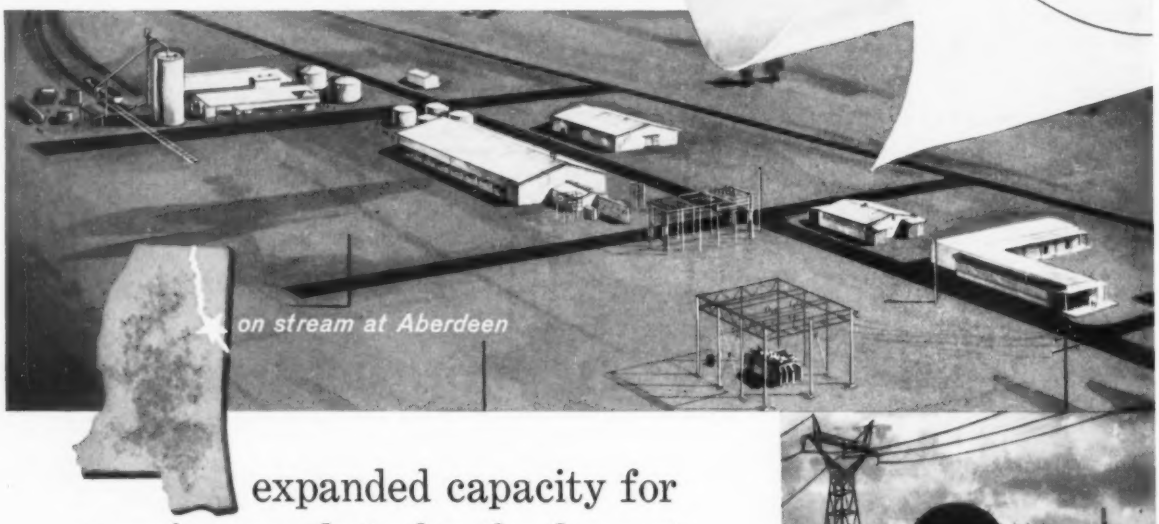
LIVE BETTER ELECTRICALLY

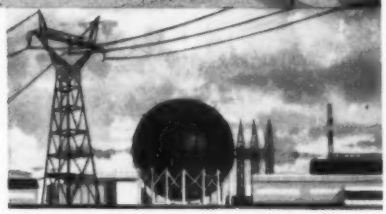
WIRE & CABLE COMPANY

79 Sidney Street, Cambridge 39, Mass.

Now! Trona®
SODIUM CHLORATE
from Aberdeen, Mississippi







expanded capacity for growing markets by the *largest* domestic producer of $NaClO_3$

The big news in sodium chlorate is TRONA's new electrochemical plant, now on stream at Aberdeen, Mississippi. This latest AP&CC facility provides faster and better service to the South's growing pulp and paper production centers, as well as further assurance of dependable sodium chlorate supply for other important markets in such fields as agriculture, uranium ore processing and solid propellant fuels. Aberdeen's readily expandable, initial capacity of 15,000 tons per year, added to the $NaClO_3$ production capability of Trona's Henderson, Nevada, plant makes American Potash & Chemical Corporation the largest domestic supplier of sodium chlorate...capable of meeting *all demands* from expanding commercial and military users. *Further information on Trona's sodium chlorate service and production capabilities at Aberdeen is available from your nearest AP&CC branch office.*

TRONA

American Potash & Chemical Corporation

3000 WEST SIXTH STREET, LOS ANGELES 54, CALIFORNIA
99 PARK AVENUE, NEW YORK 16, NEW YORK
OFFICES: LOS ANGELES, NEW YORK, CHICAGO, SAN FRANCISCO, PORTLAND (ORE.), ATLANTA, COLUMBUS (O.), SHREVEPORT

Producers of: BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM • BROMINE • CHLORATES • PERCHLORATES • MANGANESE DIOXIDE
THORIUM • CERIUM • RARE EARTHS • *and other diversified chemicals for Industry and Agriculture*

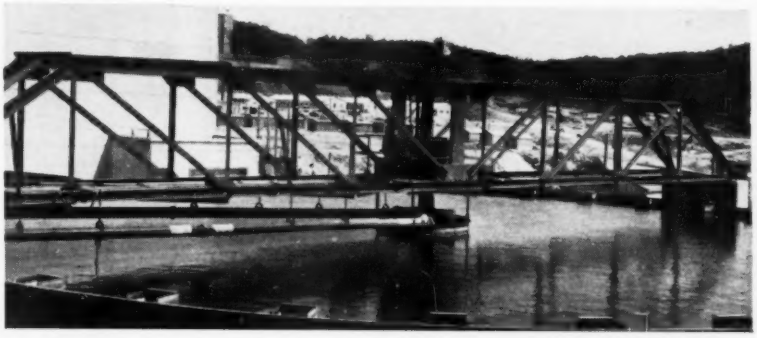
EIMCO *design and production*
PROGRESS REPORT
B-406
Process Engineers, Inc., Division of The Eimco Corporation: 420 Peninsular Ave., San Mateo, Calif.

Operating Flexibility Provided By Eimco-Process Thickeners At Canadian Uranium Mill

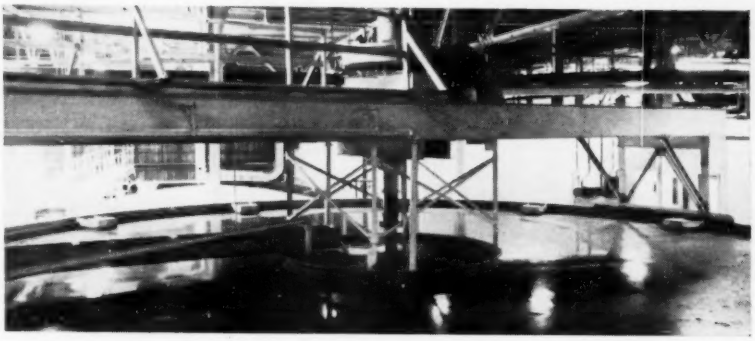
Lifting devices that can raise or lower the entire mechanisms as much as 12 inches while they are running are features of two 90 ft. dia. Type BX Eimco-Process thickeners at the mill of Milliken Lake Uranium Mines Limited, a member of the Rio Tinto group of uranium producing companies in the Algoma area of northern Ontario. These motorized devices provide operating flexibility in the washing circuit as they permit positive compensation for variations in the feed rate and ore characteristics or, if necessary, for the use of the thickeners as storage units during plant upsets.

Due to the corrosive nature of the leached pulp feed, each thickener mechanism is fabricated of Type 316 ELC stainless steel. A truss superstructure, resting on external concrete columns, supports the drive and raking assemblies. No hinged arms are used; when changes in the properties of the slurry tend to overload the mechanism, the complete raking assembly can be raised with the mechanism running, then gradually lowered as normal operation is resumed.

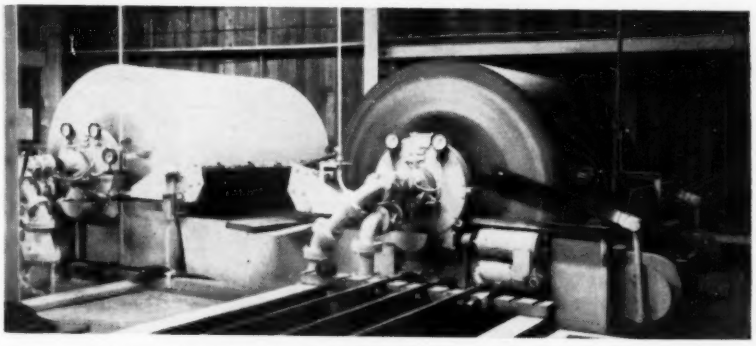
In the same mill, two 45 ft. dia. Eimco-Process beam supported units, also with stainless steel mechanisms, are being used to thicken the uranimum yellow cake slurry. Their underflow goes to one of the Eimco drum filter stations described below.



90 ft. dia. Eimco-Process heavy-duty thickener with motorized lifting device



45 ft. dia. beam supported unit used to thicken uranium yellow cake slurry



Acid leached ore is filtered by these high-capacity continuous drum filters

Rio Tinto Mill Also Uses 28 Eimco Vacuum Filters

To handle the many filtration problems involved in converting low grade uranium ores into the basic fuel of the atomic age, this mill also has installed a total of 28 Eimco vacuum filters.

Filtration equipment installed here includes drums, discs, and Agidiscs. All are high capacity continuous filters, and are used for filtering acid leached ore, uranium precipitate and neutral pulps.

Eimco equipment was chosen after first-hand observation of the fine performance of other Eimco filters in the area. Engineers at the mill had considered all types of equipment, but decided that Eimco filters could provide lowest soluble uranium losses and freedom from operational difficulties for this application.

180 Eimco filters are now operating in the Algoma uranium producing area of Ontario. Many more are in operation in other uranium mining areas throughout the world.

How AMSCO helps you MOVE

User Reports:

"OVER 13 TIMES MORE SERVICE LIFE ...WITH AMSCO 'MML' ALLOY"

"Working in semi-molten slag at temperatures up to 1800°F., an AMSCO 'MML' ALLOY dipper front lasted 528 days. That's 13 times more service life than we got from the type previously used . . .; which gave a maximum of only 40 days' service."

AMSCO "MML" ALLOY is a special combination of austentic manganese steel and molybdenum, specifically developed for applications involving excessive heating as well as severe abrasion.

User Reports:

"AMSCO SIMPLEX TOOTH GIVES 18 WEEKS EXTRA SERVICE"

"We're getting between 15 and 18 weeks extra service by using AMSCO Simplex dipper teeth", reports Mr. Fred Weber, Jr., Vice-President of Vigus Quarries, St. Louis, Missouri. "This gives us almost 4 times the service life we've been getting from standard teeth in our rugged limestone quarrying operation."

Mr. Weber also found that 2-part, reversible Simplex dipper teeth were so much easier and quicker to replace that his shovels were back on the job in no time.

MORE TONS PER DOLLAR

For rugged digging, crushing, pumping, or rebuilding jobs... it pays to ASK for AMSCO!

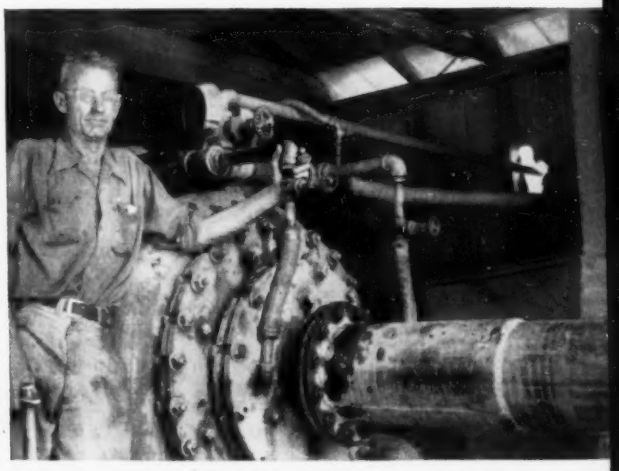
AMSCO's sole job is to help you fight wear caused by impact and abrasion. AMSCO Manganese Steel—"the toughest steel known"—is today's number one choice for long-lasting dippers, dipper parts, crushers, tractor parts.

AMSCO Alloys, developed to meet unusual wear problems, add extra service life under special and very severe operating conditions.

AMSCO Hardfacing Materials permit economical build-up or repair of worn parts—at a fraction of the cost of new parts. Use this specialized know-how and broad line of "wear-fighting" products to help *your* equipment move more tons per dollar. Ask for AMSCO!

NOW...WELD MANGANESE AS EASILY AS MILD STEEL

"We're getting just the kind of welds and build-up we want with good cost saving to boot," says a user of Nicro•Mang rod. From all over, in a variety of hardfacing applications, reports of success with AMSCO NICRO•MANG are coming in. Users like the stable arc, and wide range of arc length . . . the non-popping, the easy removal of slag . . . and above all the fast build-up. For high strength, superior crack resistance, and easy welding, Nicro•Mang is unbeatable for fabrication and build-up of manganese steel.



"29 YEARS WITH THE SAME 8" AMSCO PUMP"

Haskell Peel, Plant Superintendent at Consolidated Gravel Company, Columbus, Georgia, has shared many experiences with his 8" AMSCO PUMP. One of his favorites is the time that he and his pump almost dried out a lake to recover a sunken dredge. He hooked the 8" AMSCO to more than 1,000 ft. of 10" pipe, and ran it continuously for three days. No wonder the pump is his pet . . . it's been doing the job, pumping 75% sand and 25% gravel, for more than 29 years.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

Other Plants in: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis
In Canada: Joliette Steel and Manitoba Steel Foundry Divisions
Welding products distributed by Canadian Liquid Air Co., Ltd.

NOW..clam-action 4-in-1 PLUS values in NEW TD-6 and TD-9 crawlers!

NEW 6-cylinder diesel smoothness and power wallop! Both the new TD-6 and TD-9 Four-in-One's are powered with the millions-of-hours-proven, direct-starting, 6-cylinder International UD-282 diesel. Naturally-aspirated in the TD-6, it produces 55 net engine hp; turbocharged in the TD-9, it delivers 71 net engine hp!

New job-getting efficiency! Both the new TD-6 and TD-9 Four-in-One's have increased track length, for new tough-job stability and flotation. Both are geared with new speeds for greater tough-job capacity. Both have the power-transfer efficiency of new full-face, sintered metal engine clutches.

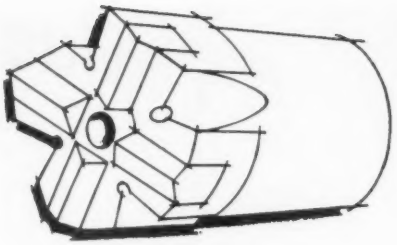
And both the new TD-6 and TD-9 have exclusive vented track-roller and idler shafts, assuring positive seal protection from over-lubrication. Big 300%-increased lube capacity shells provide 500-hr. track-roller greasing intervals!

Move the selector lever! Prove versatility unlimited of exclusive 4-in-1 as Skid-Shovel; space-saving, bottom-dumping clamshell; full-sized bulldozer; inch-close-accurate "carry-type scraper." Add up how many tens of thousands of dollars a new TD-6 or TD-9 four-in-one can save you, doubling for one limited-duty rig after another! Measure the plus value of exclusive shock-swallowing Hydro-Spring. See your International Drott Distributor for a demonstration!

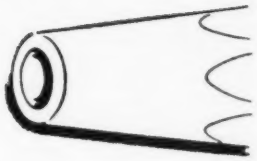
International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

New 1⅛ cu. yd. International Drott TD-6 Four-in-One. New TD-9 Four-in-One has 1½ cu. yd. bucket capacity.



Removable



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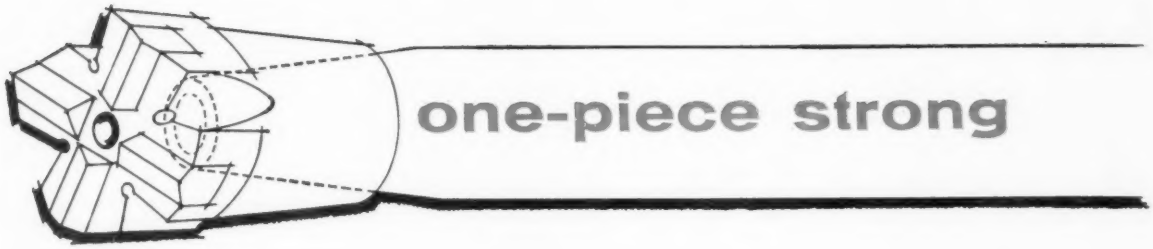


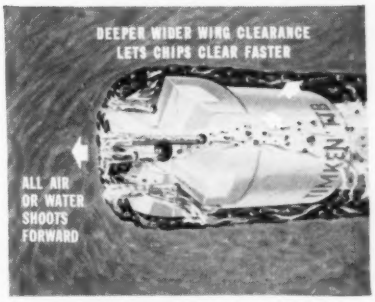
one-piece strong

That's why the new Timken® air-leg bit cuts your drilling costs these 4 ways

1. You don't have to throw away good drill steels when the carbides wear out, the way you do with intrasets. The new Timken bit is removable!
2. You don't have to haul an armful of steel to the mine the way you do with intrasets. A pocketful of Timken removable bits is enough for a whole day's work.
3. You can change bit gauge sizes fast on the same steel with new Timken bit for air-legs. Using intrasets you have to change the whole steel.
4. You carry only the bit to the shop for resharpening—when it's a Timken removable bit. With intrasets you "fight" the whole steel and Timken bits give longer gauge wear because there are *four* carbide cutting edges. Most intrasets have only two.

Get all these savings in an air-leg bit that's *tapered* for one-piece strength. And get faster chip clearance, too (see diagram at right).

Specify the new Timken tapered socket carbide insert bit for air-leg drills. For free brochure write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*



CHIPS CLEAR FASTER because 1) five front holes shoot water or air directly against the rock face and 2) deeper, wider wing clearance lets chips wash back faster.

TIMKEN® AVAILABLE NOW!
THE AIR-LEG BIT OF THE FUTURE!

HEAVY-DUTY

Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristics.

Heavier outside wires in each strand have greater resistance to abrasion.

"...and it has a much longer life"

GASKILL CONSTRUCTION COMPANY

The above quote is one of the things that Gaskill Construction Company says about the new Roebling Herringbone* Wire Rope. There are further quotes: ". . . We, after giving your Herringbone cable a great deal of use, find that it is far superior to any other cable and it is much more economical."

These are *user* statements about the newest design development in wire rope in many years. Herringbone is the regular lay and Lang lay wire rope. It is two-ropes-in-one rope, with the best features of each in combination. It has been used, with the same success quoted here, on a wide variety of machines as well as on tough hoisting jobs. Its potential is virtually unlimited wherever all-steel ropes are specified and on most installations where fiber core ropes are standard.

Your Roebling Distributor has full details on Herringbone, or contact Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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HYDRASTROKE* FEEDER
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A Reciprocating High-Tonnage Feeder easily adapted to feed Belts, Trucks, Skips, Railroad Cars, Screens and Crushers

PATENT APPLIED FOR

Exclusive HYDRAULIC OPERATION

Check these Outstanding Advantages

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Exclusive hydraulic power drive supplies the fluid to a cylinder which reciprocates the deck. Fixed or variable feeding rates are easily available through the use of a fixed or a variable volume pump. Length of stroke can be varied from 6 to 24 inches.

☑ MINIMUM HEAD ROOM

Head room requirements are reduced to as little as 20 inches. Impact damage is minimized because discharge lip of feeder is only 6 to 8 inches above lowest clearance line of feeder. Initial construction costs are reduced.

☑ ROCKER MOUNTING OR SUSPENSION

May be installed with either rocker suspension or self-contained rocker mounted units. Eliminates costly wear due to friction which is present in other types of feeders. No lubrication is needed. Feeder can take severe shock loading.

Durability characterized by special rugged construction

Wide range of sizes available . . . widths from 36" to 96" . . . feeding capacities from 300 to 7500 tons per hour.

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Subsidiary of Pettibone Mulliken Corp., Chicago 51, Illinois

NOW...a year later...same still leads in availability ...with 96.1% working record

—for Southern California Edison Co., Los Angeles, Calif.

A year later, in 1959, still meeting and beating machine-mauling High Sierra rock-hauling conditions—on Mammoth Pool Hydroelectric Project, for Southern California Edison—the same 10-unit International 95 Payhauler fleet is still turning in this excellent record of availability.

With 2,500 to 2,700 working hours clocked on each unit of the fleet, the 10 Payhaulers delivered 96.1 availability in a recent measured month. The Payhauler fleet never lost a day due to mechanical failure! Performance like this has helped advance job-completion date substantially ahead of schedule!

Southern California Edison Company credits their excellent results partly to strong-built, easy-to-maintain machines—partly to a methodical preventive maintenance program. Working view shows two Payhauler units highballing rock fill to the dam site in 1959—maintaining record high availability!

...NEW corrugated-body Payhauler models

New "95" Payhauler gains 3 tons in capacity, plus an additional 40 diesel hp.—with new corrugated body design and new 375-hp. turbocharged International DT-817 diesel engine.

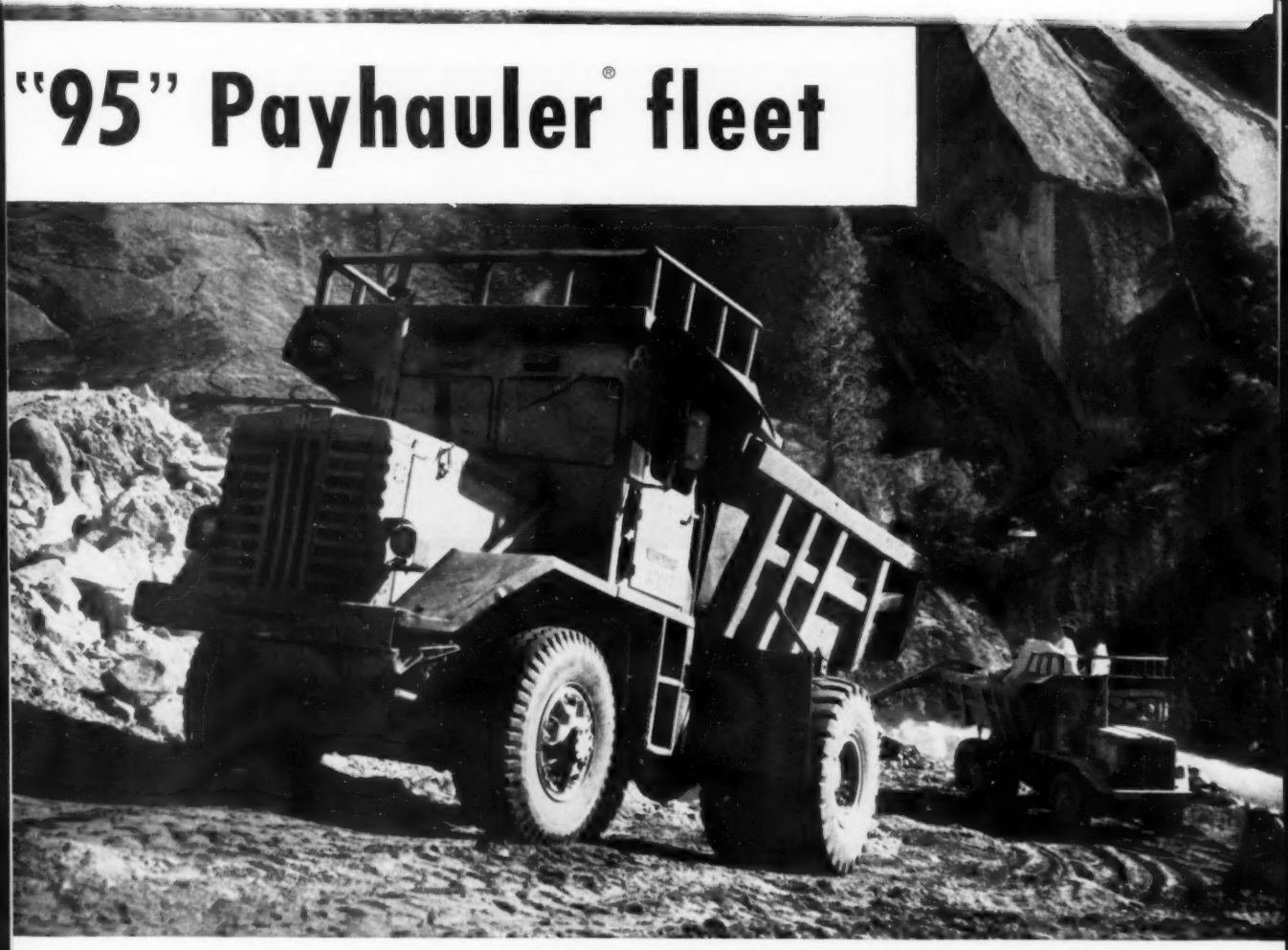
See those exclusive, rock-ribbed body corrugations! International applies this exclusive strength-multiplying principle to reduce the body-weight of new Payhauler models with these results:

- **New "95" Payhauler loses 2½ tons of power-wasting dead-weight; gives 3 extra tons of payload capacity!**
- **New "65" Payhauler sheds 5,000 pounds of useless "ballast"; gains a whole ton of new hauling capacity!**

And both these weight-streamlined Payhaulers have new International diesel power to highball the bigger payloads 14% faster than the previous models. These new Payhauler models have the power-to-weight ratio to out-cycle even lower capacity rigs.

Get the proof that new Payhauler models can deliver and keep delivering you the lowest material-moving costs in the off-highway hauling market. See your International Construction Equipment Distributor for a demonstration!

"95" Payhauler® fleet



speed bigger loads...up to 14% faster!

New "65" Payhauler, the only 19-tonner, features International's *exclusive* new corrugated body principle. Powered by the naturally aspirated new 250-hp. International D-817 diesel engine.

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A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom-Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Here's proof Coromant rope-thread bits and steels SAVE TIME AND MONEY

"Up to double the footage between sharpenings!"
"Premature rod breakage is almost non-existent!"
"40% more usable life—more resharpenings!"
"Bit and rod life are well above average!"
"Uncouple by hand all the time!"
"More rigid—drills straighter holes!"*

**Names of men quoted available on request*

The comments above are actual quotes from project managers, job superintendents, and drill superintendents who have tested new Coromant rope-thread bits and steels. They've learned, on-the-job, the benefits they—and you—can expect!

For example: The new rope-thread (only two turns per inch) holds tight in use, yet permits hand uncoupling. Reports show that the time saved results in more footage drilled per shift. Bit footage is well above average too, with less loss of carbide inserts. Prime quality ore plus nickel-chrome alloy permits cold-rolling from billets for greater strength, life and rigidity. And only with Coromant rope-thread steels can you re-thread without heat treating, too. Do it yourself, or at any nearby machine shop.

Want to know more? There's no obligation on your part, but we'll be glad to help where we can. Just call your nearest Atlas Copco Office, or write to us at Dept. MW-7.

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Atomic Blasting For Mining

Applications: Breaking a large tonnage for stripping by open pit equipment; draining and de-silting lakes overlying ore; blasting deep low-grade ore for recovery by leaching

NUCLEAR BLASTING for mining is practical, safe, and low-cost reported this panel of experts at the second symposium on Industrial Uses of Nuclear Explosives held in San Francisco in May. What is wanted most now is a company which will be willing to participate in a commercial test of methods. Panel members from left to right are: Thomas R. Young, Colorado School of Mines Research Foundation, Golden, Colorado; R. E. Smith, Sandia Corporation, Albuquerque, New Mexico; C. R. Adelmann, Lawrence Radiation Laboratory, Livermore, California; David R. Rabb, Lawrence Radiation Laboratory; and Fred L. Smith, Colorado School of Mines Research Foundation.

Feasibility Has Been Demonstrated Say Scientists

Basic feasibility of large-scale fragmentation of rock for mining and other purposes has definitely been proven, announced famed Atomic scientist, Edward Teller, at the opening of the Second Plowshare Symposium on Industrial and Scientific uses for nuclear explosions. The Symposium was held in San Francisco, California in mid-May by the Atomic Energy Commission.

Two difficulties remain to be solved, he said. First is the problem of "big effects"; one has to think twice before detonating a large device because it takes a big project, and for most efficient results a big effect is, of course, generated.

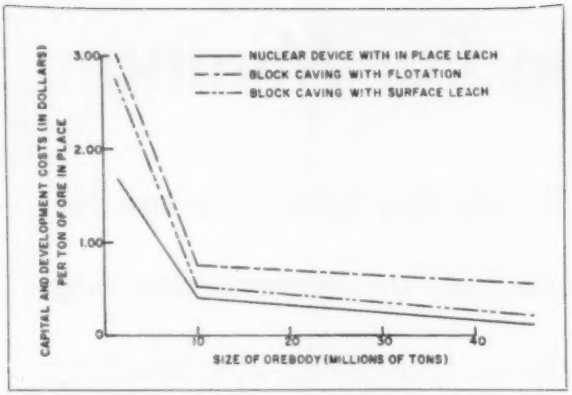
The second problem is radioactivity. For underground explosions, it can be completely contained, Dr. Teller said, but the goal, he added, and a lot of scientists are working to achieve it, is the perfection of a "completely clean" device in both large and small sizes. Big explosions are fairly clean now, he reported.

There is no question but that earth can be moved cheaply, and that volcanic tuff can be broken. There are problems and unknowns ahead, such as will other rock types break or will they solidify, the contamination problem, and the best methods to use explosions, Dr. Teller reported.

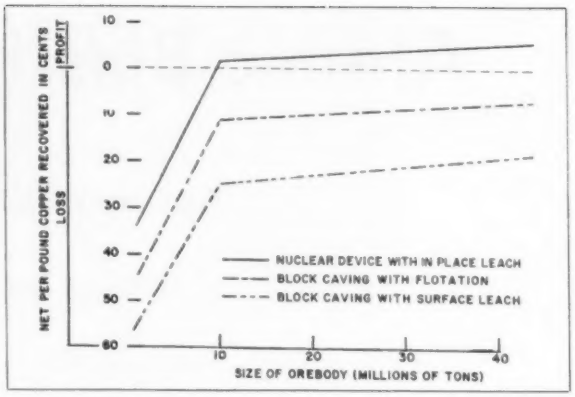
In summary, he said that we can make the explosions, can make them cheaply, but need industry help, and above all need more underground explosions to increase knowledge.

Radiation Won't Be a Hazard

Radioactive contamination from underground explosions may not be a serious problem, reported the Oak Ridge National Laboratory which evaluated radioactive release to groundwater from the Rainier test explosion in Nevada. Only about 0.5 percent was released, according to its tests. Of great interest to copper miners was the fact that only about two percent of the radioactive content of rock was released to strong boiling acid solutions after a 16-hour contact time. As weak acid solutions are used for leaching copper minerals the radioactive release to such solutions would be much slower with the result that radioactivity appears to be a minor problem for low grade copper leaching.



COST of nuclear mining decreases rapidly with increasing size of deposit. Megaton explosion is estimated to cost less than 1 percent of present underground mining.



MINING PROFIT from orebody pictured on opposite page would be possible only if it contained more than 10,000,000 tons and if nuclear devices were used.

Nuclear Mining Is Cheaper Than Conventional Block Caving

It is not economically profitable to mine a 0.5 percent copper ore body by any underground method other than nuclear fragmentation and leaching in place, reported the Colorado School of Mines Research Foundation. Fred Smith and T. R. Young reported for the Foundation on the hypothetical mining of 1,500,000, 10,000,000, and 50,000,000 ton ore bodies assaying 0.50 percent copper.

Obviously the use of nuclear blasting will be on the larger ore bodies so a detailed comparison between block caving and nuclear blasting is summarized for the 50,000,000 ton deposit.

Caving costs per ton would be:

Mining		*Milling*	
Labor	$0.67	Crushing	$0.06
Supplies	0.23	Grinding	0.20
Power	0.05	Reagents	0.12
Pumping	0.07	Flotation	0.20
Overhead	0.13	Overhead	0.15
Administration	0.10	Administration	0.07
Total	$1.25	Total	$0.80

Capital cost for caving is $27,397,000 or $0.548 per ton. Total costs would be $2.85 per ton. Two shafts and equipment are estimated to cost $3,018,000. Underground development (156,800 feet) $7,879,000, a 10,000-daily-ton mill $15,000,000, and underground equipment $1,500,000.

In contrast, the capital and development cost for nuclear fragmentation is only $9,822,000. At 40 percent copper recovery, capital and development cost is $0.049 per pound; operating costs $0.185; total costs $0.234 and the profit $0.066 per pound. Mine development cost would be cut dras-

Economic Summary of Block Caving and Milling Versus Nuclear Fragmentation and In-Place Leaching of a 0.5 Percent Copper Deposit

Ore Body Tons	Capital And Development	Direct Mining	Direct Milling	Total Per Ton	Percent Overall Recovery	Cost Per Pound Recovered	Economics At 30 Cent Copper
Block Caving-Milling							
	(Per Ton)	(Per Ton)	(Per Ton)	(Per Ton)			
1,500,000	$3.02	$1.35	$0.90	$5.27	72	$0.732	$0.432 Loss
10,000,000	0.706	1.35	0.90	2.956	72	0.411	0.111 Loss
50,000,000	0.548	1.25	0.80	2.598	72	0.361	0.061 Loss
Nuclear Fragmentation—In Place Leaching							
	(Per Pound)	(Per Pound)					
1,500,000	0.42	0.185	—	—	40	0.605	0.305 Loss
10,000,000	0.10	0.185	—	—	40	0.285	0.015 Profit
50,000,000	0.049	0.185	—	—	40	0.234	0.066 Profit

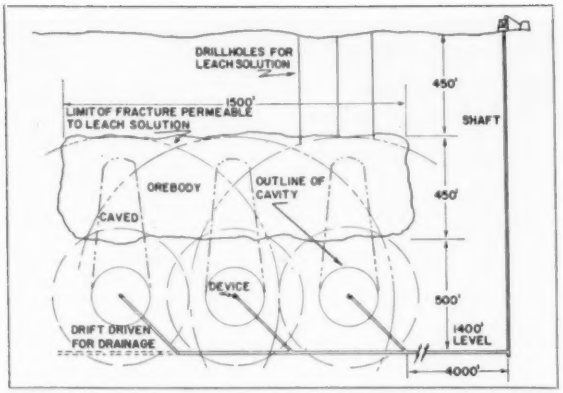
What It Will Cost to Buy a Bomb From the AEC

C. R. Adelman, Jr., Lawrence Radiation Laboratory, Livermore, California, reported that for mining operations the nuclear explosive device could be designed to fit inside a 36-inch-diameter drill hole. The device will be packed in a steel case, is 30 to 36 inches in diameter, 7 to 14 feet long, and weighs from one to four tons.

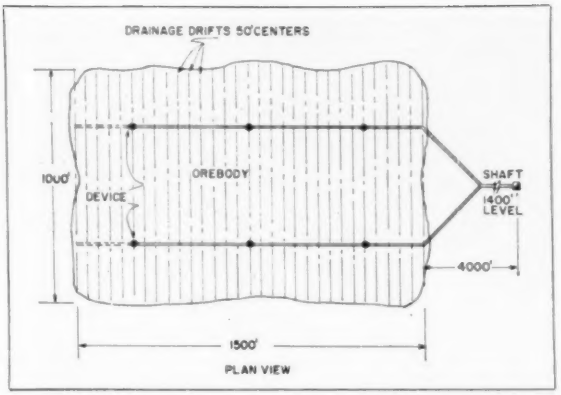
Cost of a 1.0 kiloton (1,000 tons of TNT) explosive is estimated at $500,000; emplacement cost in a drill hole at $50,000.

"Fantastic future" mining possibilities envisaged by Adelman were: Blast now, mine later, for stockpiling ore; blast and treat in place to selectively remove a contaminant so that a more uniform mill feed will result, or use it to speed up geological processing by forcing secondary enrichment processes in the breccia formed by nuclear explosions.

R. E. Smith, Sandia Corporation, Albuquerque, New Mexico, applied knowledge gained from the Rainier shot in Nevada to mining. Rainier's 1.7-kiloton shot crushed about 500,000 tons of rock and induced caving of an additional 200,000 tons. He suggested that the force and direction of underground blasts can be controlled by placing of underground openings just outside the normal crushing limits of the nuclear device. For example, an opening under the explosive will facilitate crushing of all material between point of detonation and the opening, leaving a flat bottom under crushed zone which would facilitate mining or leaching.



BOMBS would be placed below lower boundary of ore and must create maximum possible amount of new surface through which solution can percolate.



SAME OREBODY could be subjected to in situ leaching after devices were exploded. The plan view shows location of drainage ditches for collection of water.

For This Deep-seated Hypothetical Orebody

tically as only one shaft and 45,000 feet of lateral work would be needed for a total cost of $2,327,000.

The necessary equipment is different and includes pumps and pipes, surface precipitation tanks, drilling of input leach water holes, and $3,500,000 for the atomic device. Cost details are shown in table.

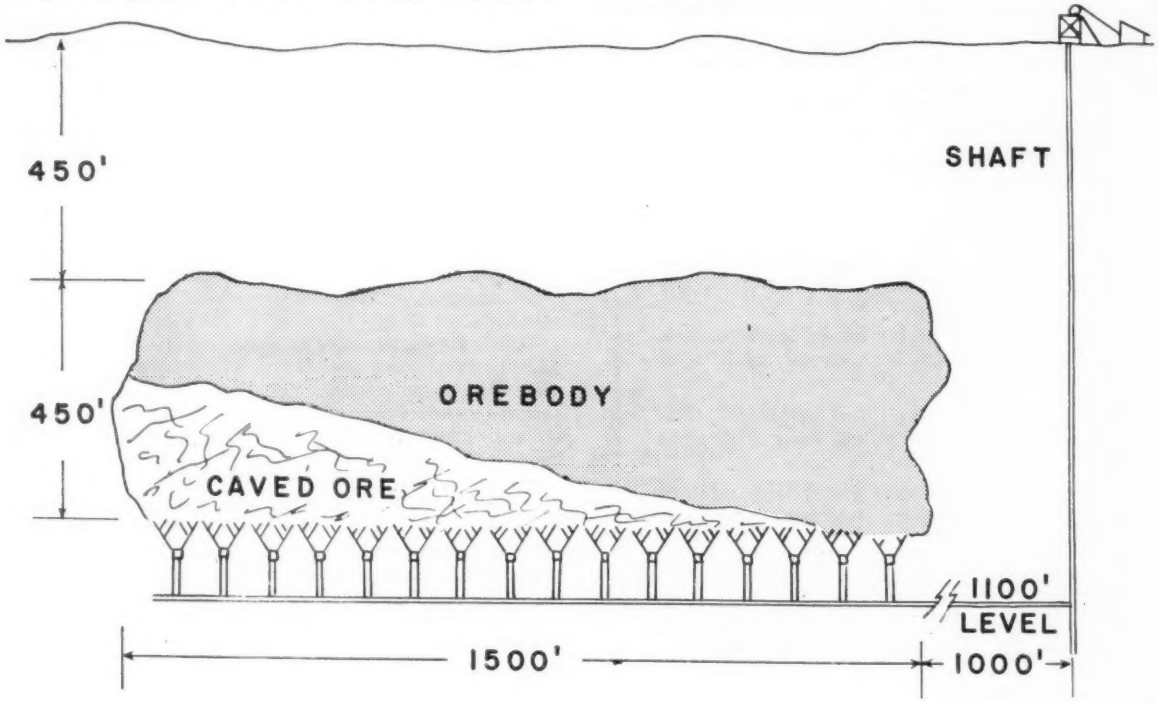
Simplicity of underground development and low cost advantages of nuclear fragmentation are shown in the diagrams on this page. Specifically there is a saving of 106,500 feet of underground openings and a saving of $600,000 in ore leaching vats.

Underground leaching costs not applicable to caving include $1,800,000 for drilling surface input leach solution holes, purchase of rubber lined pumps and pipes at a cost of $285,000, and installation costs of $220,000.

Kennecott Copper Corporation showed greatest interest in the Symposium among the mining companies and sent three engineers to the meeting. They were Lowell B. Moon, New York, New Work, Adolph Soderburg, Salt Lake City, Utah; and Annan Cook, San Francisco, California. Dick Stewart of Butte, Montana represented the Anaconda Company, and Robert Hogue, Bisbee, Arizona, the Phelps Dodge Corporation.

Other interest miners were D. M. Davidson, E. J. Longyear Company, Minneapolis, Minnesota; George C. Heikes, Continental Materials Company, Grand Junction, Colorado; and William Mattson, Kermac Nuclear Fuels Corporation, Grants, New Mexico. END.

TO CAVE THE ORE which has assumed measurements of 1,000 feet by 1,500 feet by 450 feet thick (50,000,000 tons) the following development is required: Main haulage 9,000 feet @ $55 per foot; grizzly level 18,000 feet @ $45 per foot; transfer raises 8,800 feet @ $60 per foot; finger raises 121,000 feet @ $10 per foot; exhaust airway 2,500 feet @ $150 per foot; undercutting 1,500,000 square feet @ $2.50 per square foot; plus 10% for administration.



SNORKEL MUCKING MACHINES clean muck out of decantation sumps. Air motor discharge hoses are lengthened and fastened to frame so that units can operate in deep water.

SLUSHING WET ORE in thin stopes has advantage of clean mining. Sticky gummy ore is characteristic of material after it has been moved from muck pile at face.

How Miners Solve Tough Problems at

By George O. Argall, Jr.
Editor

Why Ambrosia Lake Mining Is Tough

- **Mining is below the water table at nearly all major mines in the district.**
- **Water is present in nearly all ore. There are no large dry areas as usually found in other mines.**
- **Water mixes quickly with broken ore and waste to form a thick soup, slop, or "cream of wheat" slurry which creates many mining and transportation problems.**
- **Mine water is highly abrasive. It cuts the guts right out of high-speed centrifugal pumps.**
- **Ore slurry is tough on equipment. The abrasive sand particles eat their way right through bearing seals.**
- **Haulage roadways are impossible to maintain. Soft bottom, ruts, and pot holes tear up equipment.**
- **Broken muck settles and sticks within any container.**
- **No chutes will hold wettest ore. It rushes and splashes from cars, skips, and trucks.**

"Forget all the mining you ever knew. You have to learn all over again in Ambrosia Lake's wet uranium mines," was long the standard greeting and advice for engineers arriving at this booming New Mexico uranium camp.

Today this is still good advice, but it isn't 100 percent true any more as the combined skills and the experiences of scores of engineers have been pooled to beat Ambrosia's tough and unique conditions every day.

Underground mining has made great strides in the past year. Mining is still tough, sloppy, and wet as I described it in the August 1958 issue of MINING WORLD, but progress is being made on major problems at many mines.

The ore can be and is being mined. Tonnages are up, and costs are down.

This is a special report on mining problems today and how they are being solved. Not every operator does the same thing to solve a similar problem. That's a good thing because it proves the resourcefulness of the mining industry in developing and proving several methods to achieve the identical result.

Most important for successful mining has been the fact that the rock, both ore and waste, is fairly hard. As water drains, the rock 'sets up,' so to speak, and actually hardens.

Many engineers had rightfully feared initially that many of the wet ore zones would be so unconsolidated that flowing of water-saturated sand, caving of all openings, and complete collapse would follow closely behind any mining.

Fortunately this has not happened in any major ore zone. True, there are difficulties caused by sloughing and caving problems where mine openings have been neces-

DECANTATION DAMS are built right in the drift at foot of mucking machine loading draw points. Plank dam is removed before settled ore is loaded into rock over cars.

MUCK PILE from drift round isn't as solid as it looks. Howard Robison, Kermac safety engineer, sinks into pile which turns to slop as soon as solid ore is blasted from face.

Ambrosia Lake's Wet Mines

sary in underlying Recapture shale, and in the Brushy Basin mudstone above ore-bearing Westwater sandstone.

Pillars with up to 15 percent water stand firmly between development workings in many mines. They show no sign of weight. Of course, in the future, as pillars are robbed and pulled they will show weight the same as in any mine.

At one of the earliest wet mines, stoping of ore to thicknesses of seven feet, followed by pillar pulling, has left openings 60 to 80 feet wide with no major caving.

Roof bolts with Pattin expansion shells have been used universally and all operators are loud in their praise. One mine uses chain link fencing bolted to the back in all development headings. Light weight, 16-gauge, steel sheets which you can bend with your hands are being used as headboards in increasing numbers with good results. These sheets, in lengths from 18 to 72 inches, are factory punched for roof bolts. One to three bolts, depending on sheet length, are used. The bolts pull the metal tight against rock bending it around irregularities.

Several mines started to use steel drift sets as they started away from stations, but soon discontinued their use as they proved unnecessary.

A few timber sets are being used. Almost always this is where a fault (very small displacement—inches to a few feet—and with a water inflow) is crossed; and occasionally at a major drift-cross cut intersection.

Don't think for a minute that the ground is safe. It is not. It is treacherous. Especially in wet mines. Many slabs fall without warning from the back and ribs. Changes in bedding, cross bedding, and shale and mudstone partings

How Problems Are Solved

► The ground is largely self supporting. No exceptional difficulties have been encountered where artificial support is necessary.

► Ore blocks can be drained ahead of mining.

► There are no major underground rivers or water filled caverns.

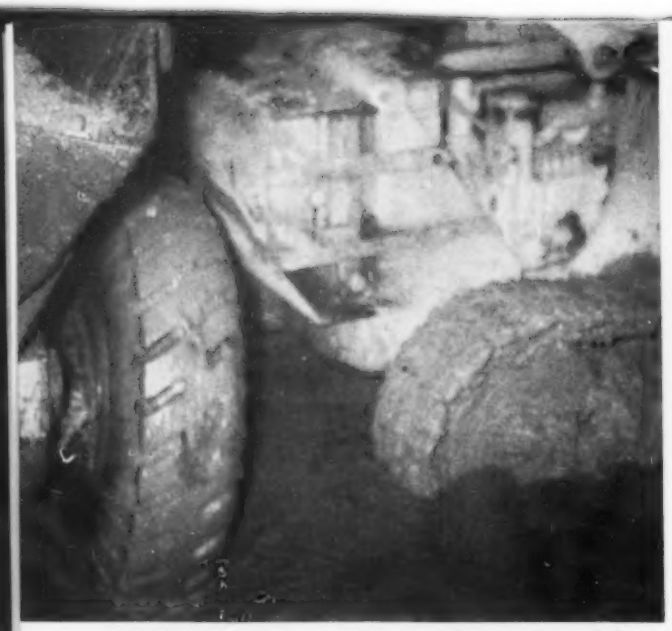
► Water can be desanded and deslimed ahead of shaft pumping.

► Shaft sumps can be mechanically cleaned.

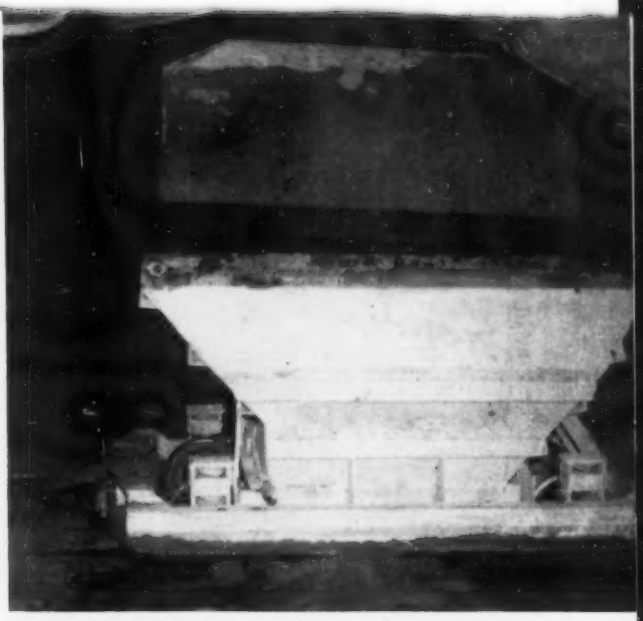
► Mechanical mining equipment can be operated in deep and abrasive mud, slime, and water. Repair costs are high but operators are learning methods to keep equipment in operation.

► Better equipment is becoming available. Each new machine incorporates important design changes based on failures of earlier models.

► Total uranium poundage indicated for the district will be recovered. However, it will require mining and milling of more tons of ore than originally calculated.



OFF-TRACK equipment operates in deep sticky mud during development at many mines. Loader operates in 12 to 18 inches of goo to muck out crosscut round.



BOTTOM DUMP CARS are used for main line track haulage in some mines. Here, a rubber-tired, front-end loader fills car with ore from crosscut heading.

make it impossible to say that any working is safe and won't slough.

Water Will Drain

Water as water never has been a problem in the district. Only two mines pump over 1,000 gallons per minute; several of the largest in tonnage and extent of workings pump less than 500. In sinking the shaft for the deepest mine on the eastern fringe of the district a sudden inflow of water at 600-foot depth filled the shaft through a pilot hole drilled ahead of sinking. This water came from the Dakota sandstone not the Westwater. This is one of the few instances of mine flooding.

Water plus broken rock creates material handling problems described elsewhere.

Mining has accomplished a water draw down above workings. The pattern is different everywhere. One mine will have a perched water table on shale beds above some ore bodies, faults will speed draining of other areas, and better lateral than vertical permeability and drainage is evident in other mines.

Desand Water To Pump

Elaborate settling and desanding systems are used to deliver reasonably clear water to station pumps. The simplest method is to use several separate sumps in series and channel all mine water into these sumps. By series settling with decantation or pumping, the majority of slime and sand is left behind in the sumps. As a sump fills with muck, water inflow is diverted around it and sump is mechanically cleaned with Eimco track mounted loaders or off-track, front-end loaders. Pumping from one sump to another on nearly horizontal levels is often necessary and the pump is hung from the back so that it operates in the highest, clearest water layer.

In some mines water from the final sump is pumped through cyclones as the final desliming step. Final overflow at all mines goes to a clear water sump. One mine which has developed a haulage and drainage level below the ore bed has a regular drilling program of long drainage holes. Water from these holes is clear and is piped directly into clear water sump. Other mines have developed a series of small sumps along the level to catch water as quickly as possible and keep all low workings as dry as possible. These sumps are pumped into one of the desanding sumps.

At another deep mine long troubled by water and bad ground, a double pump sump has been established. When one sump is filled with muck, inflow is switched to alternate. The first is then cleaned out by using a piston type mud pump to pump the slop directly into the main pump column going up the shaft. This means that the station centrifugals always handle clear water, yet only one column is needed to pump the two products. Thus muddy water is separated into two components which are pumped separately and rejoined to leave the mine as muddy water.

Shaft Sumps Are Problem

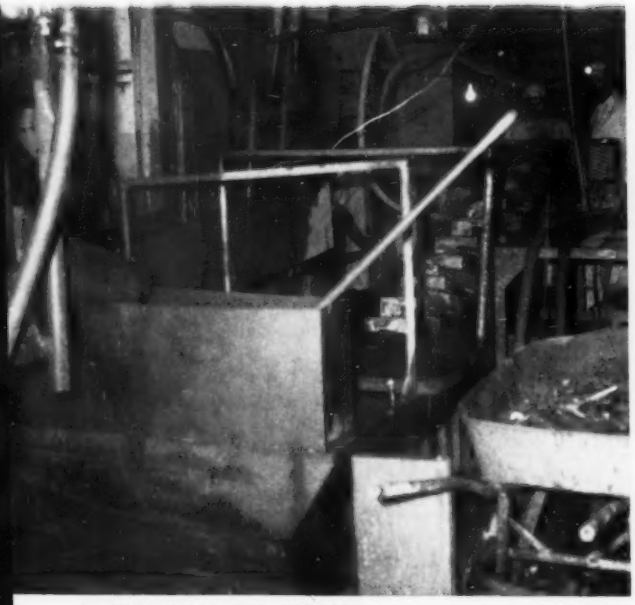
Hand mucking, bucket elevators, sand pumps, and clam shell buckets are all used to muck out main shaft sumps. Cleaning sumps has been a constant battle at most mines.

Several mines have installed bucket elevators from the shaft bottom to the slusher trench level. Because the wet muck either packs in pockets or rushes and gushes out of any chute yet built, the larger mines use slusher trenches for skip loading. Muck can be controlled and there is always the chance to mix in drier ore with wet ore to make a less sloppy product. Of course it has happened that wet ore had to be mixed with drier ore, too, to prevent it from just plain sticking in the skip to the point it wouldn't dump.

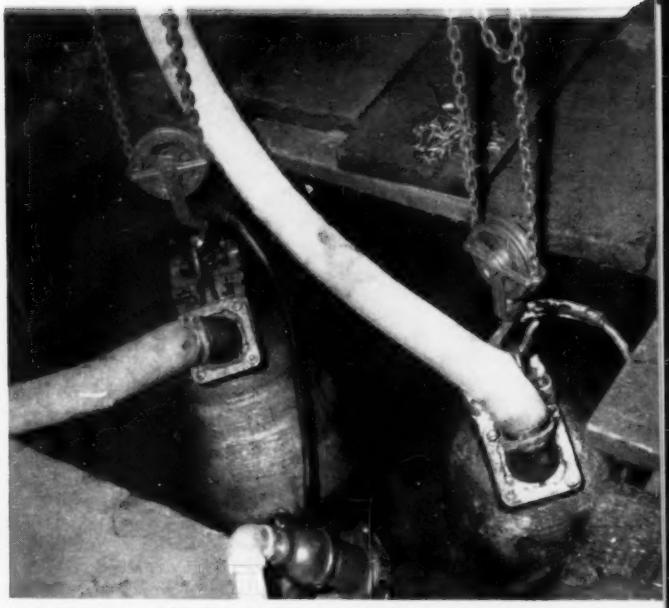
Bucket elevators discharge to desanding sumps or mechanical desanding equipment. Other mines use a clam shell bucket mounted on a cross head for sump cleaning. An auxiliary hoist mounted on level station raises and lowers the bucket. Use of the clam shell ties up one compartment for hoisting but, nevertheless, is successful because hoisting in some shafts is in one compartment only. Other mines are going to clam shell but mounting it on station so that it can be swung into shaft for sump cleaning and back onto station when hoisting is underway. Clam shells dump into slusher trench through aprons or chutes. A variation is to swing the bucket over the top of skip in adjoining compartment and load skip directly without muck going through the trench.

Some of the smaller mines use a sand pump to keep the shaft sump cleaned out. Use of an air jet in line from pump to decantation sump is very effective in increasing pump capacity.

At the district's newest deep mine an elaborate pumping system based on experience is being installed. Permanent station pumps will be installed



MECHANICAL DESANDING of mine water involves elaborate classification and pumping. Sand and slime are discharged from classifier to slusher trench behind men.



ELECTRIC PUMPS suspended at top of station sump pick up clear water layer on top and pump it to main sump. Pumps are raised and lowered as sump level changes.

in station above the main working level. Booster pumps on the main level will feed main pumps. This virtually precludes possibility of flooding entire shaft. Desanding will be done by screw classifier and cyclone in series so that clear water is delivered to main pumps. Sand and slime will feed to slusher trench.

The newest plan to be tried in the district is pumping of sandy water directly to surface without desanding. Rubber-lined sand pumps are being used as well as two-cylinder, high-pressure, positive displacement sand pumps. Control of speed is a problem of the latter.

Several mines have multiple, two and three, level development and in these mines there is a growing tendency to transfer all water as quickly as possible to lowest level. This simplifies pumping and speeds drying of upper levels. Four-inch-diameter holes drilled from level to level with a drifter are used as water drains.

Water is a very valuable commodity after you finally get it on surface for the two large uranium mills at Ambrosia Lake proper. At several mines all water is pumped into thickeners. Overflow is pumped to mill reservoirs and the underflow is surface dried and shipped to mill as ore.

Ore Grain Size Important

Experience has proven that the physical composition of the ore is important in determining what happens as it is mined. The coarser bedded sandstone will drain faster, regardless of amount of water it contains. Coarse beds are usually clean beds, too, with little silt or clay, so a minimum amount of slop is formed. It is the interbedded shale lenses that are slop forming to complicate mining. One company has its geologists hard at work closely mapping and predicting sandstone limits so that development headings will be drier. A longer curved drift will definitely be driven if it stays within the sandstone.

Drilling and breaking the ore and waste have never been a problem. Airlegs, using either tungsten carbide tipped integral steel, or carbide bitted steel, are widely used for drilling. One steel is used to drill complete hole. Electric blasting is preferred. Powder is 45 percent strength in 16-inch sticks to speed loading. It's not unusual for two men to drill three, and often four, eight-foot heading rounds a shift using 28 to 32 hole rounds in a typical 12- by 8-foot drift. Crew specialization is common; the machine men drill, while a separate crew load and blast the rounds. Some mines use special roof bolting crews; at others, miners drill and bolt their own drifts.

Nearly all production to date has been from driving of large headings, drifts, and crosscuts, as the mines are developed. One mine terms stoping as the robbing of pillars on retreat. Ore is slushed from these stopes because it is safest method. Recovery has been virtually complete with roof spans over 60 feet wide not caving while pulling pillars.

A great deal of thought and preparation has been done for mining of high ore—some of it up to 60 feet thick. One deep mine is set up to cut and fill a series of transverse stopes. Waste lenses in the ore will be left as fill and additional fill will be introduced down raises as needed.

At another mine a plan has been developed to mine a large block of high ore by retreat slicing upwards. The first step is to establish a series of draw points under ore. From these raises an undercut will be established in the lowest part of the ore. Simultaneously a series of drifts and crosscuts will be driven in the top of the ore. The next step will be to drill a series of vertical down holes through the ore block. Bottom of these holes will be loaded from undercut and a horizontal slice blasted off. Then a series of similar slices will be blasted, but the powder will be lowered from top to the bottom of each hole. Holes will be plugged or powder suspended to prevent it from dropping into stope. The broken ore from slices will be pulled through draw points.

One mine has started a series of modified square sets with 10-foot posts to mine thick, high-grade ore.

Sand filling has started and will grow in use for mining pillars in thick ore—say over 12 feet. Sand tailing is used at one mine and will be used at others. At another mine a surface sand dune will be slurried and dropped through drill holes for filling. Sand filling first started to recover pillars along the margin of an ore body. A series of crosscuts had been advanced at right angles from a main haulage way to the edge of the ore body. The first step was to erect a timber barricade along the edge of each pillar. Lagging was placed with a 6-inch vertical opening between successive timber. A solid timber bulkhead with decant holes was then built at the throat of each crosscut and lined with No. 10 burlap. The back end of the crosscut was a face of waste so lining was not necessary. The crosscut was

then filled with sand. The same procedure was followed for the other crosscuts. The pillars were then mined.

Direction and spacing of crosscuts normally varies from mine to mine, depending on ore thickness and ground conditions. There is, however, a difference of opinion on angle that crosscut is turned from main drift. Angles of 90, 60, and 45 degrees have been used. Most mines using 90° pattern turn crosscuts left and right opposite each other fom heading. One mine turns at 60°, but staggers the crosscuts on opposite sides of the heading. This speeds development and minimizes a bad bottom as equipment turns less. One group don't like the 90° pattern because they feel it opens up too much ground and timbering is often necessary. Another group doesn't like the angle pattern because it will ultimately form a wedge shaped pillar on retreat which will cause trouble as back caves. Another mine manager feels that the angle pillars will naturally become round as they take weight and can be pulled with no problems.

Loading-Hauling Problems

Air, electric, and Diesel powered loaders of many types have been tried. Diesel-powered, front-end loading units predominate, while electric units have virtually disappeared. Loading rates are high but maintenance of equipment presents many problems. Some operators feel that the Diesel units are too complicated. Repair costs are too high as motors, clutches, brakes, axles, springs, tracks, rollers, batteries, and lights give trouble.

Torque converters have been important on many units subject to terrific shock loading. Some of these units overheat, however, and must be cooled with a running stream of water which lowers operating time and adds more water to an already saturated roadway.

At one property, electric driven Joy loaders were modified to air motor drive with good results. Several of these have been converted to slusher ramps with double drum air hoist mounted on top. The conveyor on boom continues to be used to load haulage trucks.

One large operator has recently bought several new slusher ramps with double drum hoists mounted on crawlers for loading.

Both tired and crawler tracked loaders are used. Trend is toward the tired units. Operators feel that these units have greater speed and lower maintenance costs. Also, they don't dig into soft bottom at turning points. Both will and do high center at times. The crawler units bang and rattle on rock bottom loosening many parts. The tired units create long ruts which quickly fill with running water to form bog holes.

Many operators now remove all grease seals from new loading and haulage equipment and reverse them —not to keep grease in, but to keep abrasive mud out of bearings.

Trouble-free, low maintenance cost loading and haulage equipment is still needed most at Ambrosia's wet mines.

Haulage ways are still the biggest problem for off-track mining. It is impossible to maintain a ditch. There is terrific pumping and wave action due

Continued on page 67

Here Are Ambrosia Lake Mining Companies

Calumet & Hecla Inc.'s uranium division is operating the Marquez mine on the southern end of the district. Mine is developed for stope to surface stockpile truck haulage through long incline. Upper workings all dry. Now sinking incline below water level. Crawler tracked, front-end loaders with Diesel truck haulage.

Four Corners Exploration Company is the newest major producer in the district. Operates small but high-grade wet mine. Developed by sub level track haulage. Hoisting through vertical shaft. Slushes broken ore from development headings to draw points.

Homestake-New Mexico Partners operates the Section 32 mine. This is the first large mine below the water table and has pioneered many methods for handling wet ore and sandy water. Electric slushing in stopes to draw points for sub level track mucking machine loading. Was the first mine to rob pillars over a large stoped area.

Homestake-Sapin Partners operates two deep wet mines. Section 25 has been very wet with bad treacherous ground in Recapture shale. Developed by sub level tracked drifts with raises into ore horizon. The Section 23 mine is preparing to mine one of district's largest and thickest ore bodies by cut and fill stoping. Multi-level development. Thin ore is mined by rubber-tired, front-end loaders. Main haulage by locomotive on track. Has made high speed production from dry Section 15 mine with crawler tracked, front-end loaders.

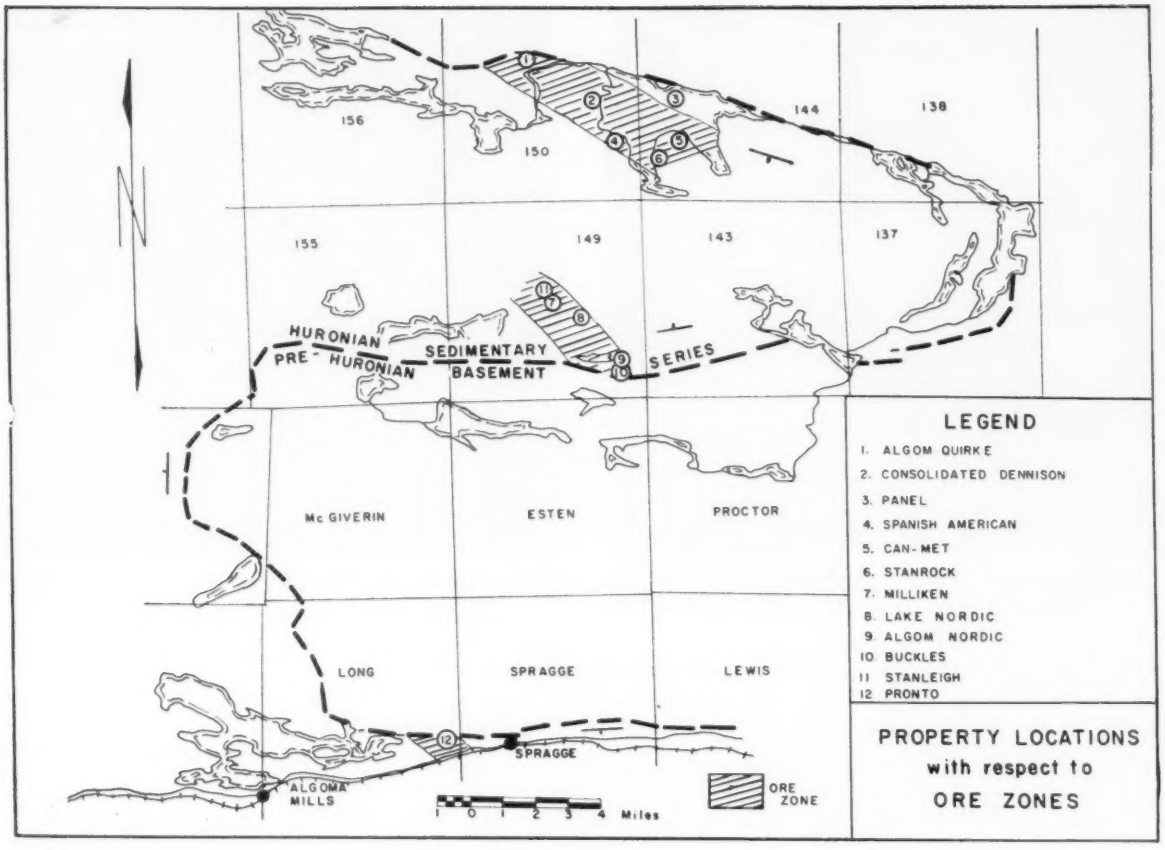
Kermac Nuclear Fuel Corporation is largest mill operator and ore reserve holder in district. Has been rushing development of four major wet mines. Its Section 22 mine was the first wet mine to develop high ore. Multi-level mine where upper levels are now dry which is encouraging to all district operators. Kermac has mined out its dry Section 10 mine.

The high-grade very wet Section 30 mine has made all production from development headings. Output rapidly increased from development after stations had been cut. Haulage conditions very bad in this mine because of very wet ground, the fineness of the ore, and the large number of shale silt and mudstone lenses in ore. Vertical shafts have been completed, stations cut, and level development well advanced at the newest mines—Section 24, and Section 17. The last three mines all develop in the ore bed using Diesel-powered, crawler mounted, front-end loaders, as well as new rubber-tired loaders.

Phillips Petroleum Company has pushed mining fast to supply the second largest mill from one shaft, the Ann Lee. Now developing the Sandstone mine and sinking the Cliffside shaft. Both very wet. The deepest shaft in the district will be at Cliffside. All development at Ann Lee in ore horizon with Diesel loaders and haulage units. Was first mine in district to use square sets and sand filling.

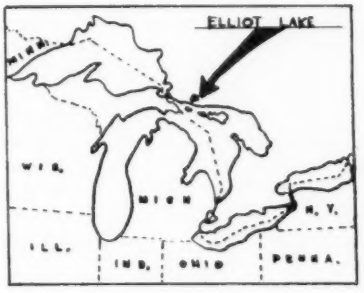
Rare Metals Corporation of America is developing the San Mateo ore body in extreme southeast section of district. Very large water inflows and bad ground have slowed sinking the deep shaft and lateral development. Drilling indicates important ore body which will be developed through sub level tracked drifts and raises therefrom.

Rio De Oro Uranium Mines, Inc. The major dry ore producer. Was the first mine to get into large-scale production and proved that dry ore could be cheaply mined. Fully mechanized mining with high output per man-shift. Hoists through the Dysart shaft only a few hundred feet from discovery site of Ambrosia Lake.



At Elliot Lake in Canada

Twelve big underground mines and eleven new plants for treating uranium ore were developed on Z-shaped contact. The district boasts 35,000 tons of daily milling capacity, but frantic pressure to bring mines into production added painfully to capital costs.



The biggest crash program in the history of mining has come to an end with the development of the fabulous uranium district at Elliot Lake, Ontario, Canada.

Here are a few facts that explain why this district is one of the most important mineral sources ever discovered. The area contains more than 80 percent of Canada's total milling capacity, and uranium is now the Number 1 mineral export in Canada.

Published figures place Elliot Lake uranium reserves at about 350,000,000 tons of 2 to 2.5-pound ore, or about 350,000 tons of uranium oxide. This alone is more than the presently estimated 230,000 tons of uranium oxide contained in the entire 82,000,000-ton reserve of known uranium districts in the United States. Local geologists at Elliot Lake, however, say that published Canadian reserve figures are conservative, and that 500,000,000 tons is a more realistic figure for Elliot Lake.

Nowhere in the world can such a concentration of uranium production be found. If the size of the operations is impressive, the speed with which the mines were brought into production is even more astonishing. Ore was discovered in 1953. By the end of 1958 all of the mines and plants were in operation.

The scramble to start mining, however, has caused an acute set of growing pains in the district. Procurement contracts are set to terminate in 1962 in some cases, 1963 in other cases. This imposes severe production deadlines on operators who hope to recover capital and development costs by the end of the contract period. The pressure to get into production, led to costly short cuts, added 15 to 20 percent to pre-production costs, and saddled every company in the district with a huge debt to finance. The fact that capacity was reached by all producers is a real tribute to those supervisors on the firing line.

Maps from "Mining, Metallurgy & Geology in the Algoma Uranium Area," Prepared for The 6th Commonwealth Mining & Metallurgical Congress.

CONSOLIDATED DENISON mine was planned for an output of 12 tons per manshift, all of which will eventually be hoisted through No. 2 shaft on shore of Quirke Lake.

BACKS can be a problem if not properly handled; overbreak into hanging wall can start a peeling condition which is hard to cure; rockbolts, good mining are the controls.

Ore Is Amazingly Uniform in Grade and Distribution

One horizon has so far been economically important. This is the lower 100-foot portion of a group of Huronian sediments which lie with great unconformity on a pre-Huronian, granitic basement. The ore is concentrated in quartz-pebble conglomerate beds that range in thickness from 15 feet down to single pebble layers.

Brannerite, uraninite and minor quantities of pitchblende are the major ore minerals, and they are contained in the matrix of the quartz-pebble conglomerates. Pyrite is an important accessory mineral that may be present in amounts of 3 to 8 percent of the ore beds. Significant amounts of thorium have also been noted in ores of the Elliot Lake district.

The deposits are found on the flanks of synclinal troughs that plunge to the west. The Quirke Lake trough on the north has been the scene of the most intensive mine development. Pronto Uranium at the southern edge of the district is on the north flank of a similar trough which dips beneath Lake Huron. The ore bearing beds show remarkable continuity over distances that can be measured in miles. Conglomerates which host the beds do not blanket the entire district, however, and may be completely missing in certain areas.

The siliceous uranium beds are relatively flat lying. The steepest dip is 37° which occurs at Algom Quirke. Pronto has dips ranging from zero to 30°. Most of the other mines have dips that average between 15 and 20° with the exception of Stanleigh which has a dip of only 8°. Mineable thickness ranges from 6 to 32 feet; the average is about 9 feet. Ore deposits are displaced from a few feet up to hundreds of feet by faulting, and local rolls affect the dips at most properties.

Methods: For Flat Beds Trackless Equipment

There has been great debate over the relative advantages of track versus trackless mining in the district. It is significant to note that several of the mines employing trackless equipment are being converted to more traditional methods. In these cases dips have turned out to be steeper than indicated by pre-production drilling.

In general where dips are less than 20° planning and purchases were based on utilizing trackless equipment in a room and pillar development or in large open stopes. At mines with steeper dips, slusher stopes and track haulage are common features. Whether ore is developed by room and pillar or by wide stope blocks, mining is carried out on the dip of the orebody. Consolidated Denison tried strike mining, but abandoned the idea because the backs proved too difficult to control. Stanrock Uranium is developed by room and pillars which are oriented at a slight angle to the strike to reduce working grades for trackless equipment.

Experience has also shown that the conglomerate beds are quite brittle in nature. This factor, coupled with shearing plane weakness means that some roof support is necessary even in some of the relatively shallow mines. At the deep mines, backs can be fairly explosive under wide spans. This situation is easily controlled, however, by limiting stope widths and by rock bolting. Great care is exercised in all mines in the placement of back holes for stope rounds. Smooth backs have proven far easier to control and contribute importantly to roof stability. The ore has proven to be very abrasive. Gauge loss on carbide bits has been high.

Mining costs have been higher than anticipated. Where most firms had hoped to mine and mill the ore for $8.50 to $10.00 per ton, actual costs during 1958 ranged from $10.00 to $12.00 per ton. The biggest contributing factor to this situation was the lack of pre-production drilling. Some mines were developed with a capital expenditure of $25,000,000 on the basis of information gained from four to seven drill holes. This is traceable to the rush to get into production and high drilling costs (up to $17 per foot). Following initial production, the operator's search for the best combination of equipment to handle production has contributed to increased costs.

TRACKLESS MINING was dominant in early development stages at Algom Nordic; mine now operates under both track and trackless methods; photo shows an Eimco 630 mucker.

STOPES are benched underhand at Algom Quirke after slot is established; 12-foot wide walkway is carefully scaled next to faces; machine is Joy airleg.

Algom Nordic

Algom Nordic is under Rio Tinto Management Group, and is located on the south limb of the Quirke Lake trough. This deposit is remarkably uniform. It strikes north 80° east and dips to the north at 14 to 18°. The deposit extends from about 50 feet below the surface to a depth of about 2,000 feet on the dip.

At Algom Nordic the ore averages 10.5 feet thick. The production shaft was collared in the hanging wall roughly midway between the ore extremities along the strike. The vertical shaft crossed the ore horizon at a depth of 565 feet. This provided 4 working levels up-dip from the shaft and ore intersection. The level interval is so spaced to provide approximately 300-foot slope lengths along the dip. The levels are interconnected by a surface incline which serves as a fresh airway (10- by 16 feet) through which 250,000 cubic feet of air is forced down into the mine and exhausted through the production shaft. This opening is also used to bring heavy equipment into the mine. Auxiliary service raises interconnect levels midway along the strike.

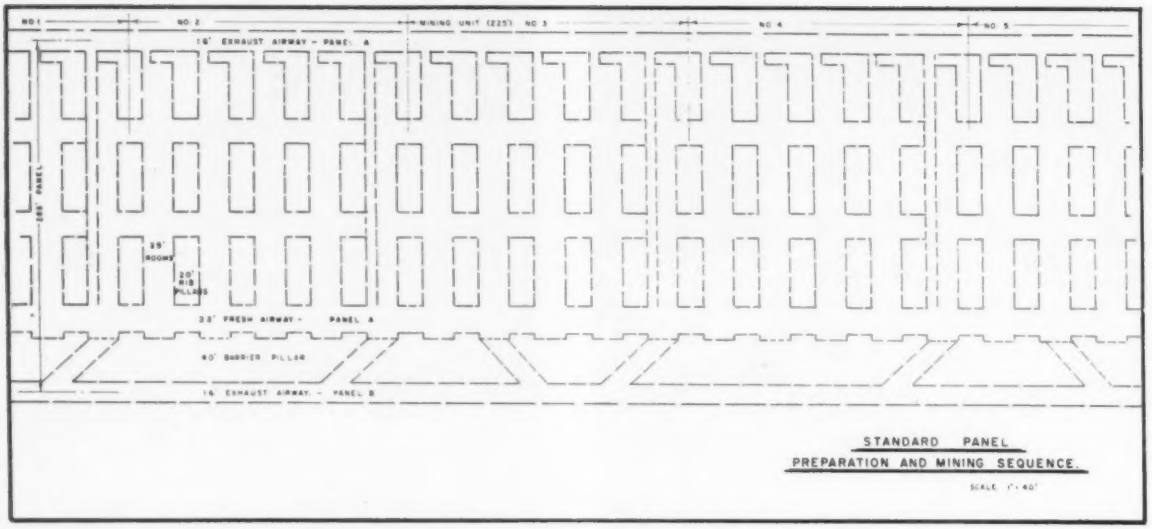
At the main levels, crosscuts are driven to the ore intersection and then strike drifts are turned off right and left. These headings are 10- by 14 feet in cross section. Initial plans were to lay out stoping blocks 100 feet wide along the strike drifts. Alternate stope blocks were to be mined to the limits of the ore, then take the pillars on the retreat. These stope blocks were to be developed by turning off load drifts on approximate 200-foot centers to parallel the strike drift leaving a 10 or 20 foot pillar between the two. The turnouts were driven up-grade (maximum of 10 percent) and were collared at a stope boundary. All stopes were initially developed by driving a 5- by 7-foot pilot raise in the center of a stope block. The pilot raises, after holing the level above, were slashed out to 20 to 30 feet wide. Following the slash, flat dipping stopes were drilled with crawler-mounted, two-boom jumbos and the broken ore was bulldozed with Caterpillar D-6 to the strike drift where it was loaded by Eimco 630 or slusher and ramp on Joy and Torkar shuttlecars. Steeper dipping stopes were drilled with airleg machines and mucked to the turnout with slushers. The shuttlecars transported the ore to a centrally located ore pass.

This system has been modified somewhat to shorten the stope spans. The result has been greatly improved roof conditions and backs are now readily controllable through the use of occasional rock bolts and care in placing back holes in stope rounds. The modification also placed increased emphasis on airleg drilling and slusher mucking.

Stope blocks are now 130 feet wide with a 10-foot pillar in the center of the block. They are developed from load drifts that are now turned-off the strike drifts on 150-foot centers. An 8-foot wide chute is installed in the load drift at the center of the block and a single raise is winged out in ore to a width of 24 feet at a distance about 35 feet above the chute. At the top of the winged raise, two parallel 5- by 7-foot raises are driven to the next level, leaving a 10-foot wide pillar. Each raise is then slashed out to 20 to 24 feet in width. The slash is carried full width by drilling up-dip holes in the breast with airleg machines. When the 20 to 24-foot wide slash has advanced to the next level, the stope span is then widened to 65 feet on each side of the center pillar by underhand benching from the top.

Both jumbo and airleg stopes are still worked at Algom Nordic but the central pillar with reduced spans make it more difficult to realize full efficiency from equipment mounted on crawler treads. Most of the newer stopes are mucked with slushers. The hoist is installed in a station cut out of the load drift wall opposite the chute. As extraction advances towards the extremities, increasing use is being made of train haulage. Boxhole connections, 30 feet long, are driven from the main level into the bottom of the stope. The boxholes are loaded by scrapers.

Algom Nordic was planned for a daily production of 3,000 tons. It was the third mine to be brought into production and has achieved full capacity. The Nordic mine, along with Algom Quirke, has been called upon for greater than anticipated production to help augment output at several of the mines in the Northspan group in 1958 when the latter were striving to come up to capacity.



BLOCKS in panels at Consolidated Denison are first outlined with 8- by 8-foot pilot raises before rooms are stoped. If ore is over 12 feet thick rooms are advanced by benches; if ore is less than 12 feet thick, rooms are advanced full cross-section size. This mine makes the most extensive use of conveyors in the district.

Consolidated Denison

In the rush to acquire holdings in the Elliot Lake district, Consolidated Denison turned up with the largest ore reserves in the area. They are conservatively estimated at about 136,000,000 tons of 2.76 pound-per-ton-ore, or enough to support operations for 60 years at the present milling rate of 6,000 tons per day. Located on the north limb of the Quirke Lake syncline, the deposit is characterized by two ore beds, near the basement, separated by pebbly quartzite 3 to 6 feet thick. This is the zone included in the above mentioned ore reserves. About 100 feet above the basement, another discontinuous ore bed exists, which is believed to represent a down-dip extension of the bed worked by Algom Quirke to the northwest. The upper bed is not included in present reserve calculations.

The lower beds strike south 65° east and dip 17 to 19° to the south. This horizon averages about 17 feet in thickness though in certain cases the ore may be up to 32 feet thick. It is developed from the surface by two vertical shafts on the western shore of Quirke Lake. Two-thirds of the orebody is under the lake itself. The northern shaft (No. 1) intersects the lower ore horizon at a depth of 1,600 feet. The No. 2 shaft, approximately 0.5 miles down-dip to the south, crossed the lower ore beds at a depth of 2,465 feet.

The mine was planned for room and pillar methods utilizing trackless equipment and conveyor transfer of ore from active panels to the shafts. Early development of the mine took place from the No. 1 shaft. Since it was temporarily the only opening to the mine, DC-powered shuttlecars loaded from portable or timbered slusher ramps were used. Upon completion of the No. 2 main production shaft, more Diesel equipment has been employed since greater ventilation can now be furnished to the mine. No. 2 shaft will gradually take over the entire production load of the mine. When this is completed No. 1 shaft will be retired from all ore hoisting duty and will serve as a service and ventilation shaft. Crushing and grinding facilities are located on the surface at the No. 2 shaft site.

No. 1 and No. 2 shafts are connected by a main 5-entry incline on the approximate dip of the orebody. Mining panels, 283 feet wide, are laid out at right angles to the main entries. They are developed by a 2-entry system of strike headings at the boundary between panels. Each set of strike headings consists of a drift on the up-dip side that measures 22 feet wide, by the height of the ore, and a 12- by 16-foot drift driven along the hanging wall on the down-dip side. The barrier pillar between the two is 40 feet wide. The larger heading is the production opening from which 25-foot wide rooms are driven up-dip to hole adjacent panel development. Rib pillars 20 feet wide are left between the rooms.

The panels are worked in 225-foot blocks (measured along the strike), and ventilation is circulated to working areas by block looping methods. Fresh air is brought into the block by the down-dip production drift. It circulates up-dip through the rooms to the hanging wall drift at the upper end of the panel where it is exhausted to the two outside headings of the main entry system.

When a pair of panel development headings are initially driven, the smaller exhaust airway (hanging wall drift) is kept about 100 feet ahead of the parallel fresh airway on the other side of the 40-foot barrier pillar. The exhaust airway thus serves as a probe heading, and reveals any change in formation which might require some variation in mining development. In addition, drill holes are normally pushed out ahead of the exhaust heading as a precaution since most of the ore is under the lake. The barrier pillar between the exhaust airway (for the panel down-dip) and the production drift (for the panel up-dip) is holed at intervals with a horizontal cross cut. The exhaust airway is driven full cross-section in size; the fresh airway is advanced by benching.

In the vicinity of No. 1 shaft, loading is handled by slushers and ramps. There are 11 ramps in the mine mounted on tractors. Four are straightaway ramps and seven are swivel ramps. All other ramps are built of timber at the mine. The slushers are 30 and 50-horsepower units with 60-inch Pacific scrapers. Haulage units

in the panel are Joy SC 14 shuttlecars with a 14 ton capacity.

In the vicinity of No. 2 shaft Cline Diesel trucks of 8 ton capacity are being used. In this area another interesting piece of equipment is being applied. This is a Scoopmobile which is tire-mounted and features a swivel frame. It is a front end loader with a one-yard bucket. Though it requires an 11-foot vertical clearance it will muck down a 15 percent grade and backup 300 feet to load a truck. The machine can muck out a 20-ton round in 2 hours and 15 minutes.

The mill at Consolidated Denison has been up to capacity for nearly a year. It is the biggest producer in the Elliot Lake District and the company has played a leading role in the development of the area.

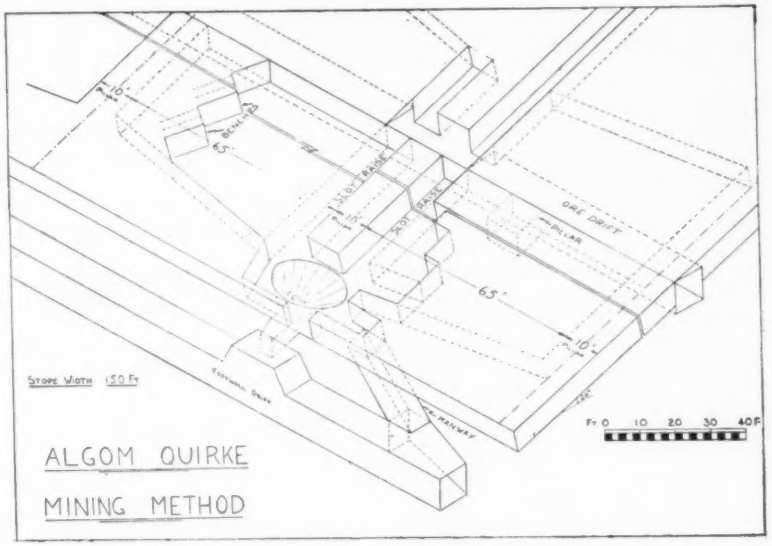
Algom Quirke

Pre-production planning was based on the use of track methods because dips were comparatively steep at the Quirke. Every attempt is made to minimize dilution and daily production is governed by an elaborate ore control program. Experience has shown that about 50 percent of the milling cost originates from consumption of reagents, balls and other steel lining. Excessive dilution of ore with waste at the mine is directly translated into increased treatment cost. Stoping, therefore, is very selective at the Quirke mine.

The shaft intersection with ore provided room for six working levels up-dip. From these six levels, hanging wall crosscuts are driven to the ore and level development along the strike is then turned off right and left. Strike headings consist of an ore drift and a footwall drift on each level. The ore drift follows the contour of the beds, and this results in a crooked heading. Efficient track haulage requirements necessitated driving footwall drifts that were engineered for collection of ore by trains. An ore pass system leads to the sixth level which is tracked with 60-pound rail. The sixth level handles all the production from the fourth and fifth levels and 90 percent of the ore from the third level. This ore pass provides about 3,000 tons of storage.

Spacing of level development provides stope lengths along the dip of 300 feet. The stopes are divided into 150-foot blocks along the strike. There is a center pillar, 10 feet in width, in each block and 10-foot pillars between stopes.

The most commonly used stope development consists of driving short 5- by 7-foot raises from the footwall haulage drift to the lower end of the stope. These raises are placed at 150-foot centers at the center axis of the blocks. The sill elevation of the stope is approximately 24 feet above the base of the rail in the footwall drift. A 6- by 8-foot manway is also put up from the footwall drift at an inclination of 50°. The 5- by 7-foot raise is belled out to about 20 to 24 feet in diameter at the base of the stope and provides 75 to 100 tons of storage capacity. The top of the bell is slashed out to make room for a slusher set-up and a walkway. Two parallel slot raises measuring 6 feet high and 8 feet wide are driven up-dip to the next level. The pillar along the central axis of the stope between the slot raises is 10 feet wide. The slots are widened out by taking three successive 5-foot wide by 6-foot high slashes up-dip parallel to the slot raise. This cut is advanced to the next level. Slashing of a slot raise is carried out on a 2-shift basis with 2 men to a shift. The crews slush the round, rock bolt if necessary, drill out and blast three rounds.



SLUSHER STOPES at Algom Quirke are reasonably typical of mines in the district which have adopted trackless methods. Dips vary from a low of 20° to a maximum of 37° at Algom Quirke. The ore bed averages 12 feet thick, but upper three feet is so interbedded with waste that only the lower 8 or 9 feet are mined.

One side of a stope is worked at a time. This leaves a 65-foot wide span when the stope is completed. After the slash of a slot raise has been finished on one side of the stope, it is mined by underhand benching methods from the top to the bottom. The procedure is to drill six holes to a bench arranged in two vertical rows of three each. These holes are drilled with airleg machines and 12-foot lengths of steel. Burden on the holes is 2½ feet. The benches are advanced faster at the top of the stope to provide a natural funnel to the collection raise at the bottom as an aid to slushing. The stoping crew for this cycle consists of two drillers on one shift who drill out and blast, and two slushermen on the opposite shift who scale the back, wash down, slush broken rounds to the collection raise, clean off the benches and set-up drilling machines for the drill shift.

The average stope is driven about 8 feet in height since this is about optimum for speed and control. If ore is thicker than this it is sliced off on the return. The ground is very hard and abrasive. The penetration rate of drill steel is 12 to 13 inches per minute. While benching in the stopes, drillers average about 140 feet per drill shift. Joy AL 47 airlegs are used on the benches with ¾-inch, lugged, hexagonal steel. Hard Metal 1½-inch tungsten carbide bits of the tamp on variety are used. The bits have a useable life of about 275 feet. The abrasive nature of the ground causes a high rate of gauge loss and many bits must be retired that still have a great deal of carbide wear remaining.

Algom Quirke along with Algom Nordic has assumed the burden of increased production so that ore shipments could be made to mines in the Northspan group, also managed by Rio Tinto. The Quirke mine is one of the long-life properties of the district and has been an important leader in the district.

New Guides to Chrysocolla Flotation

Test Program Indicates the Following Conclusions:

By JOHN A. JAEKEL

1. Chrysocolla can be activated and floated by a method of sulphidization that is easy to control.
2. The reagent combination may yield satisfactory recovery of other oxides and sulphides in a mixed copper ore.
3. Of the many reagents studied, Aerofloat 31, Reagent 404 and Reagent 425 appeared to be most effective.
4. Sodium sulphide and hydrous sodium sulphide were suitable sulphidizers; the latter gave a better froth with pine oil.
5. Consistently good copper recoveries were obtained in neutral to alkaline flotation circuits.

The copper metallurgist has long needed an inexpensive series of easily controlled reagents to float chrysocolla ($CuSiO_3 \cdot H_2O$) in a basic or neutral circuit to produce a good grade concentrate with satisfactory recoveries.

The need is obvious considering that chrysocolla represents a substantial percentage of the total copper content of some low-grade oxidized copper ores. It is usually found associated with cuprite, malachite, azurite, native copper, and other copper minerals that are recoverable by present day flotation practice. While most of these other copper minerals are recovered, the chrysocolla is invariably lost in the tailing. Therefore, any application of flotation reagents that will float the chrysocolla and part, or all, of the other copper minerals present would be of considerable value to the industry.

And with millions of tons of low-grade oxidized ores being developed in Arizona, oxide flotation will grow in importance.

Chrysocolla has been observed in small acicular crystals but is more commonly cryptocrystalline or amorphous. Crystalline varieties of many oxide minerals are easily recovered by flotation[1]. Because of this, the crystalline variety was avoided in this work. No crystalline material was observed in the Inspiration Consolidated Copper Company's chrysocolla furnished by it and used in the tests reported here.

The purpose of this study was to develop a successful method for the recovery of chrysocolla and accessory copper minerals at a treatment cost commensurate with costs presently reported for copper ores containing approximately 2.0 percent, or less, of copper. Since no successful commercial method has been described for flotation of chrysocollo[2,3], it was decided that the investigation would be first confined principally to studies of the pure mineral. Then, if successful with this, the method, or methods, would be tested with a natural ore containing other minerals of copper as well as the silicate.

There has been very little published on the flotation of chrysocolla. The U. S. Bureau of Mines has reported two methods for the recovery of the copper silicate from a synthetic ore[4, 5]. The Bureau obtained maximum recoveries, around 95 percent, at a pH of 4 using sulfidization and a sulfide collector. Grade of concentrate was not given. Another and more recent report on recovery of chrysocolla from a synthetic ore is that of Dr. R. W. Ludt and C. C. Dewitt[6]. Using modified malachite green dye as a collector, recoveries of up to 68.4 percent were reported. Maximum grade of concentrate given was 10.3 percent but this was with a substantially lower recovery.

Several years ago, the writer found that a concentrate grade of up to 28 percent copper with a recovery of 95 percent was possible on the synthetic ore. However, the methods used were very sensitive and difficult to control.

A later series of flotation tests with the synthetic ore were started in April of 1956 with the express purpose of developing a less sensitive and more practical method for floating the copper silicate and other oxidized copper minerals. Procedure, data, results, and conclusions of this later test program are reported below.

Test Procedure

Each charge of synthetic ore was prepared by mixing 30 grams of Inspiration chrysocolla (22.6 percent Cu) with 570 grams of Ottawa sand yielding a mixture which computes to a copper content of 1.13 percent.

The screen analysis of the chrysocolla was similar to that of the flotation feed in some large porphyry copper plants. The mineral was ground coarse, not only to duplicate the practice of the mills, but also to test the efficacy of various reagent combinations developed for its flotation since the coarser material is more difficult to float. The screen analysis of each component of the test flotation charge is shown in Table No. I.

Table No. I

Screen Analysis of Mineral Components in Flotation Feed

	Chrysocolla		*Ottawa Sand*	
Mesh	*Percent Weight*	*Cumulative Percent Weight*	*Percent Weight*	*Cumulative Percent Weight*
48	6.57	6.57	0.15	0.15
65	19.63	26.20	0.55	0.70
100	21.80	48.00	5.9	6.60
150	15.15	63.15	29.35	35.95
200	10.74	73.89	21.85	57.80
−200	26.11	100.00	42.2	100.00

The flotation cell used in all tests was a standard 600-gram Fagergren laboratory machine. When the cell was charged, the pulp averaged about 25 percent solids. Addition of the reagents and conditioning in the cell averaged about five minutes with three to eight minutes flotation time. Distilled water was used in most tests due to the chlorine and salt content of the tap water. The pH of the pulp was determined with a Beckman line voltage pH meter.

Synthetic Chrysocolla Flotation

Some of the previous work was repeated and many new tests were made in the 1956-1957 period. Neither im-

Mr. Jaekel is metallurgical engineer for the Mining Experiment Station, Division of Industrial Research, State College of Washington at Pullman, Washington.

provement in recovery nor concentrate grade were developed by this later work. However, more effective combinations of reagents were found. Flotation of the chrysocolla became far less sensitive and therefore much easier to control.

From a long series of tests, combinations of reagents were developed for the successful flotation of the chrysocolla from the synthetic ore. Four of the most promising of these reagent combinations are given in Table No. II. In three of these tests (78-E, 78-F, and 81), sulfuric acid is used for pH control.

Table No. II

Reagents and Results with Synthetic Ore

Test No.		*78-E*	*78-F*	*78*	*81*
Heads	%Cu	1.13	1.13	1.13	1.13
Concentrate	%Cu	27.63	28.26	19.98	26.86
Recovery	%Cu	80.8	79.3	90.41	85.10
REAGENTS: Pounds Per Ton					
H_2SO_4		0.21	0.154		0.21
Zinc hydrosulfite				0.165	
Na_2S (flake 60%)		0.165	0.165	0.165	
$Na_2S \cdot 9H_2O$					0.33
Aerofloat 31		0.115	0.115	0.115	0.115
Reagent 404		0.33		0.33	0.33
Reagent 425			0.33		
Pine oil		0.12	0.12	0.12	0.06
pH		7.9	7.35	7.35	7.9

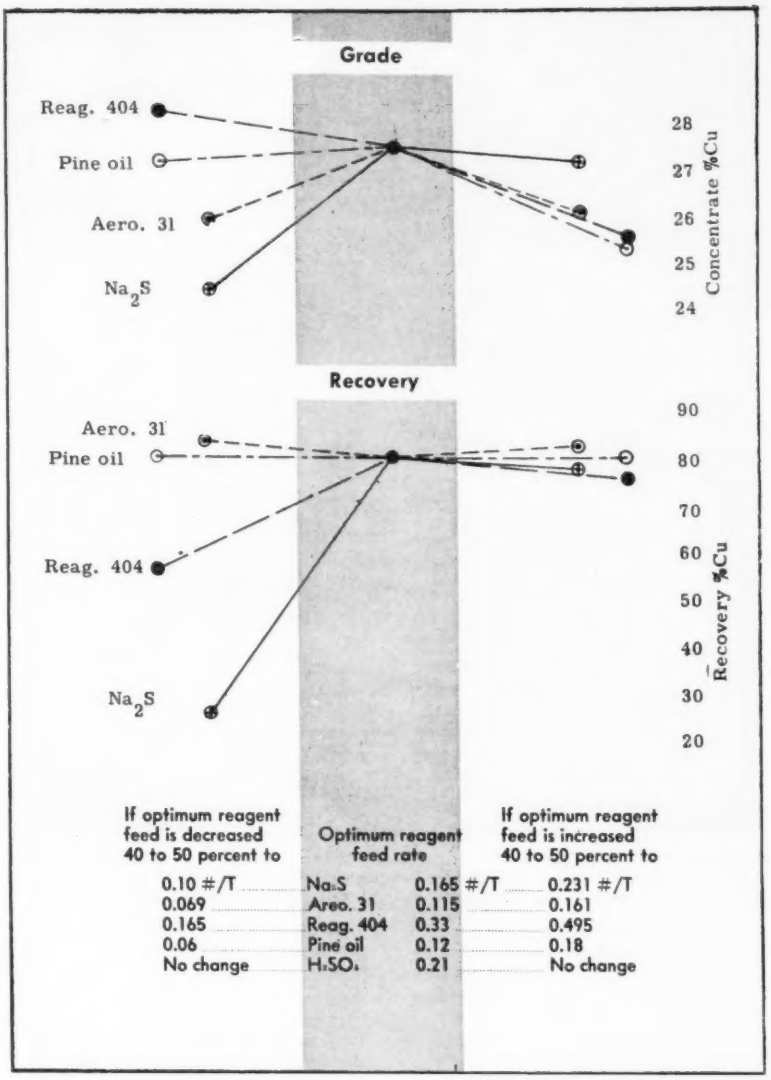
The highest recovery obtained (with sulfuric acid) was in Test 81 where hydrous sodium sulfide ($Na_2S \cdot 9H_2O$) replaced commercial grade 60 percent fused flake sodium sulfide. Improved results were due to the better froth obtained with the hydrous sodium sulfide. Any difference between Reagents 404 and 425 as a collector for chrysocolla appear to be minor.

It will be noted from Table No. II that the chrysocolla mineral was actually upgraded by flotation from 22.6 to 28 percent copper in some of the tests. This is probably due to the selective action of the reagents on high-copper chrysocolla and rejection of the low-copper chrysocolla into the tailing along with the quartz gangue.

Test 78 is one of several using zinc hydrosulfite (prepared in the laboratory) as a surface cleaner for the mineral. Since the natural pH was satisfactory with the indicated amount of this reagent, no acid was necessary. It is interesting to note that a better than average recovery was obtained. However, the grade of the concentrate was below normal (a repeat on this test resulted in a very close check on the recovery but the grade of the product dropped even lower to 14.25 percent copper).

The highest grade concentrate produced in any of the zinc hydrosulfite tests contained 22.3 percent copper. It is questionable whether this reagent has any beneficial effect either as a surface conditioner or as a promotor. The hydrosulfite serves as a pH regulator and probably activates some of the silica and the low-copper chrysocolla particles.

Ore Was Fairly Non-sensitive to Changes In Reagent Feed Rates



CHANGES in recovery and grade by increasing or decreasing the basic reagent combinations 40 to 50 percent are indicated. For example, decreasing Na_2S by 40 percent reduces recovery to 26.7 percent and grade to 24.45 percent.

None of the tests included in Table No. II were sensitive or difficult to control. A few experiments made, with considerable variation in the amounts of the reagents used, indicated that the range through which the quantities might be varied, without undue effect, were much more than expected. It was found in this work that several of the reagents (as used in test 78-E) could be cut in half or even doubled in some cases with only minor effects on the recoveries and products.

To show that the reagents can be varied as much as 40 to 50 percent, Test 78-E was taken as a standard in a series of eight flotation tests to determine the effects of decreasing and of increasing the amounts of each reagent. In these tests only one reagent was varied at a time, all others remaining constant. As shown in Table No. III, relatively large changes in the amounts of Aerofloat 31 and pine oil had only minor effects on the recoveries and grades-of-concentrates; and where the concentrate grades were lowered, the recoveries increased in some cases. With sodium sulfide and Reagent 404, it can be seen that a corresponding reduction in these reagents substantially reduced recoveries while increasing these reagents by

GROUNDWORK for further study in recovery of chrysocolla from natural ores containing mixed copper sulphides and oxides has been firmly established by the author, John Jackel. Chrysocolla is one of the commonest copper minerals.

40 percent resulted in only a slight lowering of the recoveries. See Figure No. 1 for graph of recovery and concentrate grade changes by varying reagents.

Table No. III

Recovery of Copper and Grade-of-Concentrate Obtained Using Variable Quantities of Each Reagent on Synthetic Chrysocolla Ore

	Reagents				Concentrate	Recovery
Test No.	Type	Pound Per Ton	pH	Per cent Copper	Per cent
79	Na_2S (flake 60%)	0.10	7.6	24.45	26.7
78-E	" "	0.165	7.9	27.63	80.8
79-A	" "	0.231	8.1	27.24	77.6
79-B	Aerofloat 31	0.069	7.8	25.96	84.7
78-E	" "	0.115	7.9	27.63	80.8
79-C	" "	0.161	7.85	26.16	83.8
79-D	Reagent 404	0.165	7.65	28.38	57.3
78-E	" "	0.33	7.9	27.63	80.8
79-E	" "	0.495	8.0	25.66	77.1
79-K	Pine Oil	0.06	7.9	27.23	81.6
78-E	" "	0.12	7.9	27.63	80.8
79-G	" "	0.18	7.9	25.45	81.4

The tests shown in Table No. IV (standard Test 78-E is included for comparison) were made on the basis of the results reported in Table Nos. II and III as well as other work. These tests all showed general improvement of results as outlined below.

Table No. IV

Tests to Show Effect of Variation of the Collector Reagents (Synthetic Ore)

Test No.	79-F	79-H	79-I	79-J	78-E
Heads %Cu	1.13	1.13	1.13	1.13	1.13
Concentrate %Cu	26.45	29.26	27.84	22.35	27.63
Recovery %Cu	88.6	82.0	86.3	88.9	80.8
Reagents lbs/ton					
H_2SO_4	0.21	0.21	0.21	0.21	0.21
NA_2S (flake 60%)	0.165	0.165	0.165	0.165	0.165
Aerofloat 31	0.115	0.069	0.161	0.069	0.115
Reagent 404	0.495	0.33	0.33	0.495	0.33
Pine oil	0.06	0.06	0.06	0.06	0.12
pH	7.9	8.0	7.7	7.8	7.9

Test 79-F, with decreased pine oil and increased Reagent 404 compared to the standard test (78-E), resulted in a high recovery (88.6 percent) with a relatively high grade of concentrate (26.45 percent Cu).

A decrease of both the Aerofloat 31 and the pine oil in Test 79-H resulted in the highest grade concentrate (29.26 percent Cu).

Increasing the Aerofloat 31 and decreasing the pine oil resulted in the best grade of concentrate (27.84 percent Cu), together with a high recovery (86.3 percent) in Test 79-I.

By decreasing the Aerofloat 31 and the pine oil in Test 79-J (as in 79-H) and increasing the Reagent 404, the highest recovery was obtained (88.9 percent Cu).

Flotation Of Natural Ores

For these tests samples of mixed oxide sulfide copper ore were obtained from the Loon Lake copper property located north of Spokane, Washington. Assays ranged from 1 to 3.1 percent copper. Minerals identified were azurite, malachite, chrysocolla, and chalcopyrite. Analyses of these samples and corresponding test data are reported in Table No. V.

Table No. V

Flotation of the Loon Lake Copper Ores (Natural Ores)

Test No.	1	2	3
Heads % total Cu	0.98	1.60	3.14
% oxide Cu	0.75	1.48	0.15
%Fe		0.57	3.31
Concentrates			
% total Cu	10.2	13.1	18.67
% oxide Cu	7.86	12.0	
Recovery			
Over all % total Cu	81.2	90.0	98.04
% oxide Cu	81.7	89.0	
REAGENTS: Pounds Per Ton			
H_2SO_4	0.21	0.21	0.21
Na_2S (flake 60%)	0.165	0.165	0.165
Aerofloat 31	0.115	0.115	0.115
Reagent 404	0.495	0.495	0.495
Pine oil	0.06	0.06	0.06
Reagents (Stage additions)			
Na_2S	0.10	0.50	0.10
Aerofloat 31	0.046	0.230	0.046
Reagent 404	0.165	0.825	0.165
Pine oil		0.30	0.06
pH	8.1-8.5	7.5	5.5-5.8

The best flotation conditions developed for the synthetic ore (79-F, Table No. IV) were used in the start of flotation for each test. Additional amounts of the reagents (determined by visual observation) were fed as stage additions.

It can be seen in Table No. V that fair recoveries of oxide copper were obtained in Tests Nos. 1 and 2. Test No. 3 was made with a sulfide copper ore sample to show that this sulfidization procedure will not hinder flotation of the sulfide copper minerals but appears to even better the ordinarily good results obtained with xanthate alone. END

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Paved Haulage Roads Lead To These Savings

Greater tire life . . . More truck miles per gallon of Diesel fuel . . . Reduced road maintenance and fewer grading and sprinkling shifts

LIQUID ASPHALT is added to road surface to produce a surface seal. The result: a road that is smooth, strong and capable of supporting heavy loads.

LESS DUST greater visibility are added advantages to surfacing roads. This Dart truck is loaded with 25 tons of ore and is traveling a paved haul road to the crusher.

By Donald K. Gill

By establishing a stable road base and then sealing the surface with a thin coat of asphalt, The Anaconda Company has been able to obtain durable, hard-surface roads at its open-pit mine at Weed Heights, Nevada.

Experiments in surfacing roads have been carried on for nearly two years in order to improve haulage costs. In favor of such a program were these factors. The climate is dry with an average annual rainfall of approximately five inches. The material underlying the mine roads is generally of a stable character. The alluvium obtained in stripping overburden makes very good ballast and is readily available for replacing soft material.

In the fall of 1957, a short length of haul road was prepared as follows. A proper road base was first established and compacted by the use of water and truck traffic. It is essential to stabilize the base so that the surface resists flexing under heavy loads.

Two inches of material were added on top of the base. This material was generally the overburden alluvium, but tailings from the oxide leaching plant have also been used. The two-inch layer was then thoroughly mixed with a ten percent *Orzan solution, using 1½ gallons of this solution per square yard. This material was compacted by a pneumatic roller as it was spread as an even layer on the road. Further compaction was obtained by running truck traffic over the road for about a week.

The road was then smoothed, dampened with ten percent *Orzan solution, and again rolled by pneumatic roller until a hard smooth road surface was developed. The road was then dampened with water and sealed with 0.40 gallons-per-square-yard of a high-viscosity, seal coat asphalt emulsion. After the seal coat had set, it was covered with a ¼-inch layer of sand. Traffic was utilized for a few days to work some of the sand into the asphalt. The excess sand was then swept off the road.

The results of this test were so favorable that about three miles of haul roads were paved during the summer of 1958. These roads have stood up very well and are now in good condition.

During the 1958 test, one 800-foot section of road was prepared without the addition of *Orzan and treated with an asphalt seal. This section is still in good shape and it indicates that it might be practicable to prepare certain roads at the Yerington mine for seal-coat paving without the use of *Orzan.

The total cost of paving the haul roads with the use of *Orzan has been about $4,000 per mile, including the cost of *Orzan, the asphalt seal, and the equipment time used to do the work. Roads prepared without the use of *Orzan and sealed with asphalt can be made for about $1,500 per mile. The haul roads have been prepared 40 feet wide and sealed 36 feet wide.

In one section of the haul road, a medium curing liquid asphalt of fairly high viscosity was used in place of the emulsified asphalt. It penetrated more than the emulsion and made a better bond to the road base, but it did not make as tight a seal with one application. It is thought that a light coat of liquid asphalt, 0.25 gallons-per-square-yard, followed later by a second seal coat, will make a good permanent seal.

Some cracking and checking of the asphalt seal developed after a few months as the road base dried under the seal. A light flush coat of low viscosity liquid asphalt was then applied at 0.20 gallons-per-square-yard. This filled the cracks and restored the road surface to its original condition.

After nearly a year of service, most of the paved haulage roads are in excellent condition, and only a few short stretches have required maintenance. These sections were mainly where the original road base was plastic and had not been properly prepared.

Considerable credit for investigating and developing this method of hard surfacing haulage roads goes to C. J. Houck, the mine superintendent.

It is at the instigation of the general manager at Weed Heights, A. E. Millar, that this article is offered for publication, in the hope that it may be of benefit to some other people.

END

Mr. Gill is general mine foreman and chief engineer at the Yerington mine.

*Orzan is a trade name for ammonium lignin sulfonate, a by-product of wood pulp mills.

BLACK SANDS on Atlantida Beach. This 30 centimeter deep cut shows intermixed bands of white quartz and black sand. Pen gives proper scale.

Uruguay's Beaches

Show Heavy Mineral Concentrations

By John R. Bogert

The possible importance of black beach sands on the southern coasts of Uruguay was first recognized in 1949 by the Faculty of Engineering of the University of Uruguay. A small technical article was published by the university in 1950 which was given wide publicity throughout the country. Since that date, the beach fringed Uruguayan coast has been the scene of continuing investigations by the Uruguayan government through its Division of Scientific Investigations of the Administracion Nacional de Combustibles, Alcohol, y Portland, locally known as ANCAP.

The Beaches

Beginning close to the city of Montevideo and continuing eastward some 220 miles to the Brazilian frontier, the Uruguayan beaches are noted for their beauty and fine surf bathing. Innumerable summer resorts dot the coast, as well as historical shrines and a National Park. There are, however, long stretches of coastline undeveloped and deserted.

Physiographically, the Uruguayan shoreline is a flat uplifted coast with the sea bottom sloping away very gently. The existing beaches are old barrier beaches and off-shore bars which enclose many silted-up lagoons and embayments, as well as many swamps, the ending result of the encroachment of land, vegetation, and sand dunes. In recent years, the Uruguayan shoreline has been relatively stable, neither rising or submerging to any marked degree, and coastal erosion is not pronounced.

Sand dunes are common. Prevailing southerly winds drive the beach sand landward forming sandy zones that extend a mile or so inland before being dissipated over the terrain.

Atlantida Beach about 25 miles east of Montevideo. This beach fronts a quiet residential area but it is generally undeveloped and rather isolated. Here a narrow zone almost two miles long contains high concentrations of black sand parallel to the ocean at the point of high tide.

Concentrations of black sand also occur sporadically further to the east at various points up to the Brazilian frontier. La Floresta, Solis, and Bella Vista beaches all contain notable amounts; while Costa Azul, San Luis, La Pedrera, Aguas Dulces, and La Coronilla beaches contain smaller concentrations but in larger quantities.

All of the beaches vary from 100 to 120 feet wide between the point of high tide and the start of vegetation. Solis and Bella Vista beaches, though, are notably rocky containing unconsolidated stones the size of cobbles.

Sampling Results to 50 Centimeter Depth at Atlantida Beach, Uruguay

	Sample Depth, Centimeters	*Silica Sand & Organic Matter Percent*	*Heavy Mineral Sand Percent*	*TiO_2 Percent*	*Fe_2O_3 Percent*
	0 — 10	23.0	76.2	46.1	36.2
	10 — 20	64.1	35.9	43.7	34.6
	20 — 30	85.8	14.2	44.9	35.7
	30 — 40	84.5	15.5	45.6	35.1
	40 — 50	87.7	12.3	45.8	36.6
Averages	0 to 50	69.1	30.9	45.2	35.6

The southern half of Uruguay is an early pre-Cambrian crystalline complex of gneisses, mica schists, and intrusive granites containing traces of ilmenite and other heavy minerals. Steady erosion of these basement rocks has liberated the minute quantities of these resistant minerals and carried them down to the coast where they are being concentrated today by continuous wave action at several places.

Heavy mineral beach sands are found along the entire southern coast but the area which contains the highest concentration is probably at

Sampling and Analysis

At Atlantida beach a 50-centimeter vertical section has composition shown in table.

A mineralogical analysis of the

Mr. Bogert is the former chief geologist for National Lead Company in Argentina. He has now returned to the United States. Mr. Bogert is the author of the MINING WORLD article "Valcheta—Argentina's New Mining District," April 1958, pages 49 to 51.

ATLANTIDA BEACH showing black sands in foreground. This is a typical old barrier beach where coastal erosion is not pronounced.

heavy mineral sand from Atlantida beach shows it consists of: ilmenite, 82.2 percent; zircon, 5.4 percent; monazite, 3.2 percent; magnetite, 2.5 percent; various silicates, 2.1 percent; rutile, 1.0 percent; and residue, 3.6 percent.

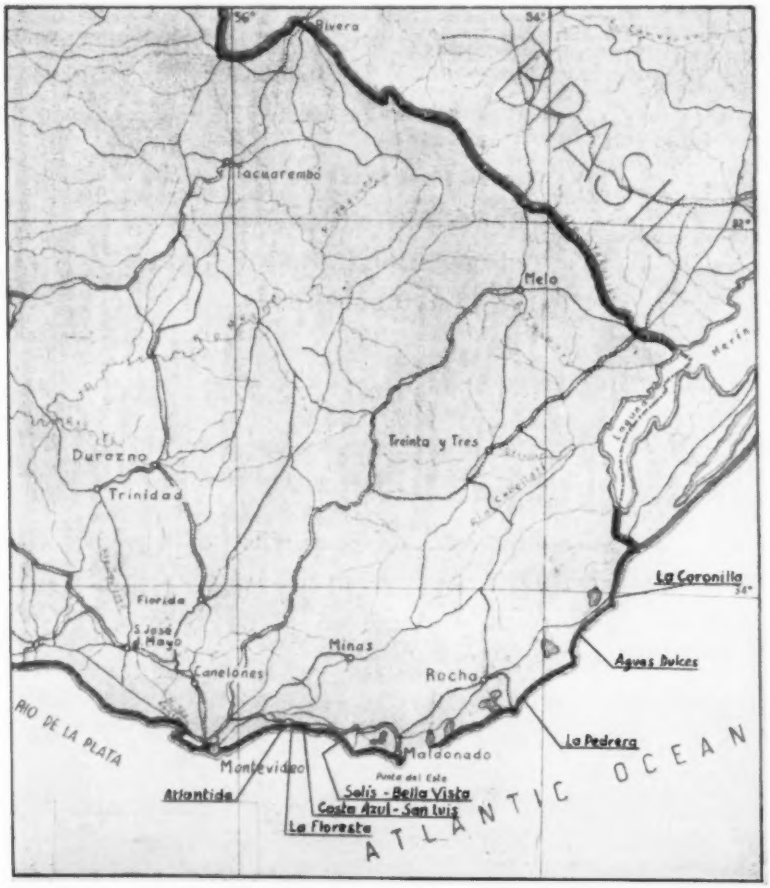
The zircon has a high zirconium oxide content (55 percent ZrO_2), while the monazite contains 4.1 percent ThO_2.

At La Floresta, Solis, and Bella Vista beaches there are quantities of sand reportedly containing 52.4, 16.7, and 18.4 percent heavy minerals, respectively, and then several beaches containing large amounts of between 2 and 10 percent heavy minerals.

In addition to the black sands concentrated on the beaches, the sand dunes further inland (100 to 300 feet from the high tide line) also reportedly contain at places 3.4 to 6.6 percent heavy minerals.

In the zone of highest concentration of heavy minerals at Atlantida Beach, it is possible to calculate some tonnage. Here in one area 9,000 feet long, 70 feet wide, and only 2 feet deep, there exists over 50,000 tons of sand. Of this amount, it is estimated 30 percent represents heavy minerals or about 15,000 tons of black sand of the quality analyzed above.

No calculations can be made for other areas where the concentration of heavy sands is lower or more erratic. Likewise, no tonnage calculations are possible for the abundant inland sand dunes.



PLACE-FIX MAP of Uruguay's black sand beaches.

Conclusions

Detailed studies of the beaches are being continued by the Uruguayan government ANCAP. In addition to the basic surveying, sampling, and analyzing, the government is now studying the concentration problems and the various other engineering-economic aspects preliminary to successful exploitation and marketing of the black sand components.

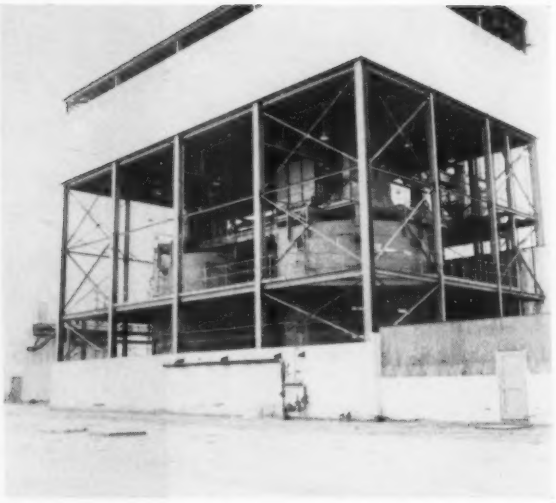
In the future, the beaches of Uruguay may well become an important source of heavy mineral black sands of significant value to the local economy.

I wish to thank ANCAP of the Uruguayan government and, specifically, Dr. Lathan Clark for his kind cooperation with regard to my investigations of the eastern beaches.

END

Skinner Furnaces

for Drying, Roasting, Calcining Incinerating and Decomposing



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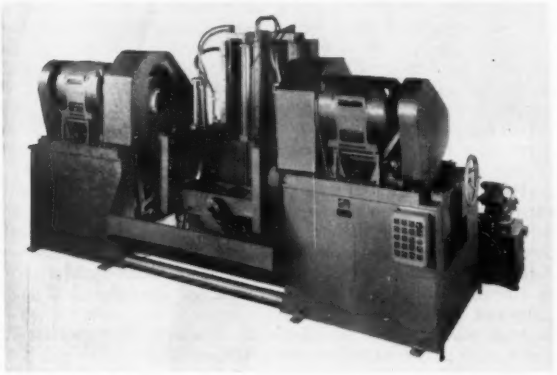
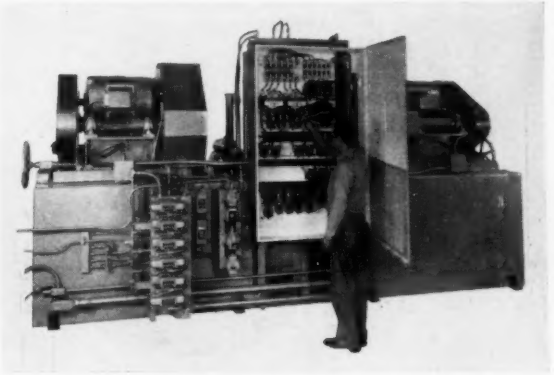
Production Equipment Preview

News about the electric wheel, remote-controlled mining, and 57 additional developments and bulletins. For data on any item on the next three pages use the inquiry card opposite page 57.





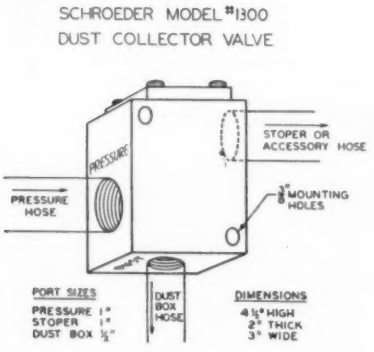
Timber Framer For Automatic Production Operation

To tenon and slab heavy timber automatically, either rounds or cants are fed into the above machine and it will double end trim, cut clean sharp tenons, and discharge framed members at the rate of three pieces per minute. Frame, crib, and shoring for mine sets can be processed accurately and quickly according to Burke E. Porter Machinery Company.

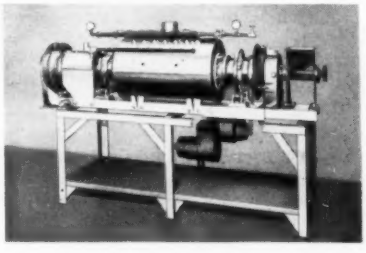
The timber is conveyor fed through the end of the machine. On reaching the work position, it is automatically equalized both longitudinally and transversely. It is then rigidly clamped and carried vertically past the cut-off and slab heads. If tenons are to be made the carriage rotates 90° and returns to the down position. Clamps release, and the piece is conveyed out through the opposite end of the machine as the next piece comes into the work position.

The No. 284 timber framer has an integrated and electrically actuated hydraulic system for the control of all movements in proper sequence. The machine features inserted type carbide saws with hogging heads which reduce the scrap to usable chips. Set-up controls enable the operator to sequence the movements from the push button station. A companion machine to the timber framer is the Porter No. 228 wedge machine. Circle No. 37.

Dust Collector Valve



New valve, model 1300, is said to reduce air consumption, save power and add to the service life of compressors. It was originally designed for mining to shut off a dust collector when a stoper was stopped; the valve, however, can be used to shut off any secondary accessory of air operated equipment when the primary unit is shut down. The unit is 4½ inches high, 2 inches thick and 3 inches wide. Manufacturer is Schroeder Brothers Corporation. Circle No. 63.



Pilot-Scale Calciner

A new research model continuous rotary calciner and cooler is now offered by The C. O. Bartlett & Snow Co. The unit is said to be ideally suited for continuous heating and subsequent cooling of ores, salts, or metal oxides in a neutral, oxidizing or reducing atmosphere. Material can be heated to maximum of about 2,000° F. and cooled to 150° to 200° F. before discharge. The calciner can be used to determine permissible operating temperatures, retention time, characteristics of special atmospheres; and data for design scale-up to commercial size. Circle No. 67.

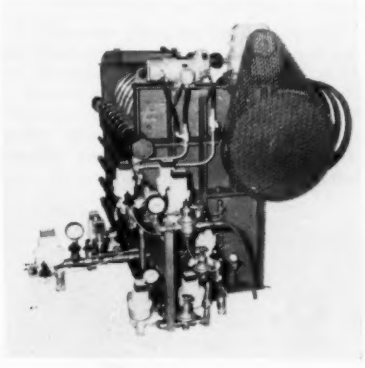
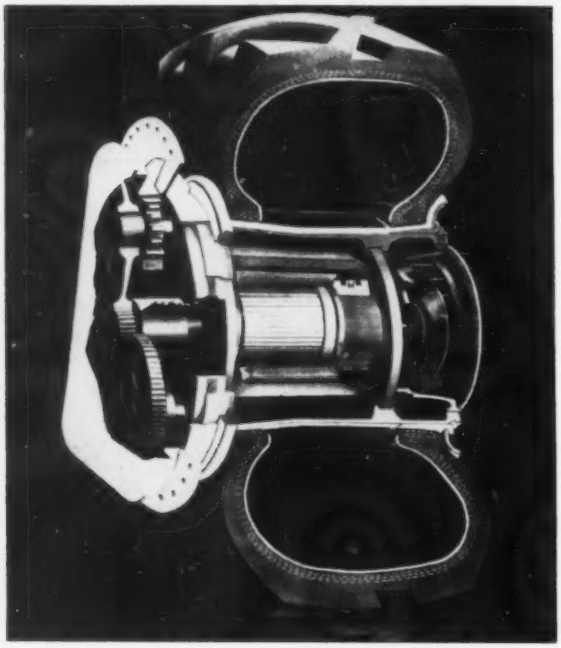


Plate and Frame Filter

Improved Eimco-Burwell filter is now equipped with an electric timing control circuit and all auxiliaries for automated operation on a multi-cycle basis. The filter can now end one filtration cycle and start another without the attention of an operator. New model is an 8-frame, 32-inch frame diameter unit available from The Eimco Corporation. Circle No. 61.

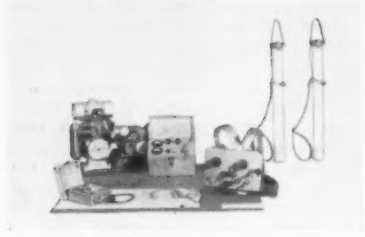
Motorized Wheel: A New Concept For Open Pit Mining



Applied to earth moving equipment, the motorized wheel will make possible a vehicle capable of moving twice the payload of existing machines for similar applications, say General Electric Company spokesmen. The drive, designed for large off-highway vehicles, eliminates transmissions, axles and gear shifts by including the electric traction motor as an integral, load carrying part of the wheel. Motorized wheels can provide all-wheel drive from a single engine supplying electric power through a direct-current generator. Multiple engine arrangements are therefore not necessary.

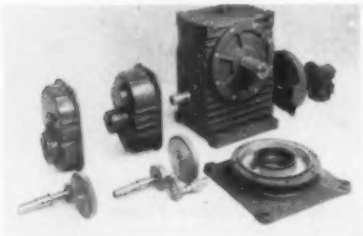
Application of electric drive for propulsion to off-highway vehicles has always been hampered by weight problem of rotating machines. The traction wheel concept is said to solve this problem by utilizing this weight to support the vehicle as well as serving as the magnetic structure of the motor. Among the advantages which General Electric claims for motorized wheel drives for earth movers are:

1. Highest horsepower utilization over the vehicle speed range of any available drive.
2. Highest continuous braking effort with no danger of fading of severest application.
3. Operators run at higher speeds with better vehicle control due to infinite modulation of braking rate and extra reserve capacity providing up to 14 mph per second deceleration.
4. Horsepower utilization independent of operator skill and judgment.
5. More working days per job due to the ability of proportioned power to match traction condition at each wheel.
6. More working hours per day with maintenance free electric drive designed for the application. For further details Circle No. 1.



Ore Prospecting Equipment

Turam method of electromagnetic inductive prospecting from the ground has been improved with new equipment, according to A B Elektrisk Malmletning in Sweden. The new unit includes staffs rather than receiver coils and this makes it easier to carry receivers over difficult terrain. Circle No. 73.



Worm Gear Speed Reducers

Five basic improvements are listed by Philadelphia Gear Corporation for a new line of heavy duty worm gear speed reducers. They include higher capacity, greater efficiency, improved drive, and mounting flexibility; availability from stock of ratios over a broad range and torque control. Circle No. 65.

Diamond Core Drill

Machine made by Hermann Von Rautenkranz Internale Tiefbohr-Kommanditgesellschaft (ITAG) in West Germany is designed to drill at any angle from vertical to a maximum depth of 1,000 feet or 1,600 feet in a horizontal direction. Hole diameters range from 1½ to 5 inches using diamond coring bits or hard-metal faced bits. The drill can be powered by air or electric motor underground and electric or Diesel drive for prospect drilling from the surface. It is equipped with a hydraulic feed head and a hydraulic griping device for drill rods up to 2⅝ inches in outer diameter. Circle No. 72.

Data on Rotary Dryers

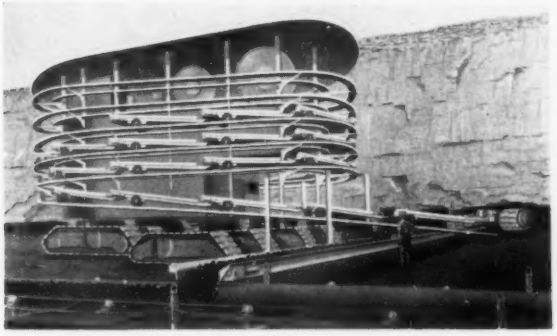
New technical bulletin on dryers, kilns, coolers and other heavy rotary equipment has been published by Standard Steel Company. Included is a discussion on how to make decisions on rotary processing equipment. Circle No. 69.

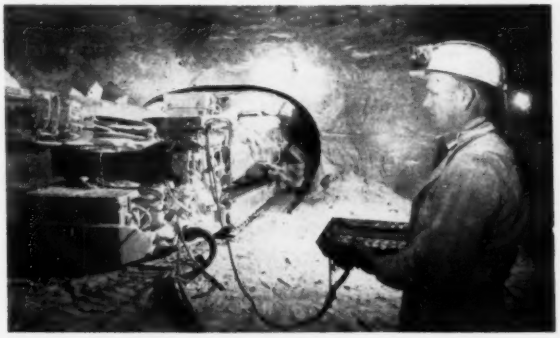
All Purpose Drill Rig For International TD-6 and TD-9

New drilling rig made by Mobile Drilling, Inc. is designed for diamond drilling in hard rock formations to depths of 250 feet through a drilling speed range from 50 to 600 rpm. In semi-consolidated material the B-40 Explorer is fully convertible to an auger drill. The unit is a steel beam and tubular frame weldment fabricated to a full width face plate which bolts to the rear of the tractor frame.

Among other B-40 features are a centralized, one man control panel; folding frame permitting drilling at any angle from vertical to horizontal; full 68-inch stroke; hydraulic rotary head drive; hinged drill head; hydraulic feed and hollow spindle drive. In traveling position the drill frame and tower lower, eliminating clearance problems of overhanging trees an other obstacles. Equipment is available from the International Harvester dealers. Circle No. 35.

Remote Controlled Mining: New Concept Underground

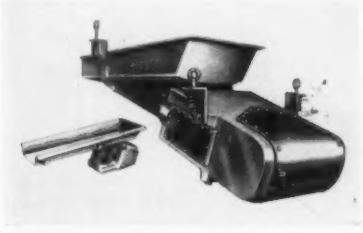




On left is an electronic miner that Joy Manufacturing Comp ny says that it will have in the field by 1960. It was designed specifically for coal, but has interesting overtones for all earth moving problems. The system consists of three major units which include a huge launching platform, a conveyor transport train, and the mining machine which is controlled electronically from outside the machine. The electronic sensing device will guide the machine no matter how the coal seam wanders; it was developed by Union Carbide Corporation which assigned production and sales rights to Joy.

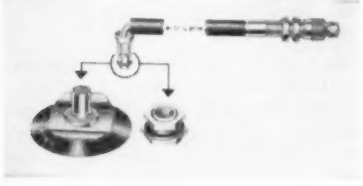
Remote control of Joy's Twin Borer is pictured at right above. The Twin Borer is used to mine six- to eight-foot seams. Control equipment enables the operator to guide the machine from as far away as 50 feet. Complete direction of work can be maintained through the control box in the operators hand. No contact with the machine is necessary but the operator must maintain visual contact.

The control box has 15 levers which actuate 27 magnetic proximity switches. Low voltage switches on the control box trigger electric relays which in turn actuate ¾-inch solenoid hydraulic valves. Oil from these solenoid valves operate the regular hydraulic valves on the machine. Circle No. 34.



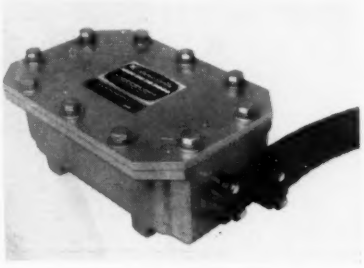
Dust Tight Covers

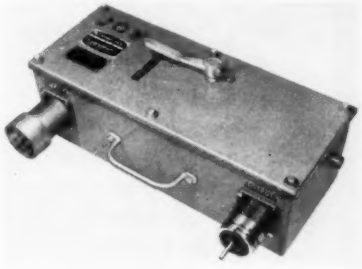
New magnet covers are now available for the complete line of electromagnetic vibrating feeders made by Syntron Company. The new development is intended to keep the electromagnet dust-free and decrease maintenance requirements. The covers consist of long-life rubber gaskets and metal plates which are easily bolted in place over the openings of the magnet housing. Circle No. 66.



New Tire Valves

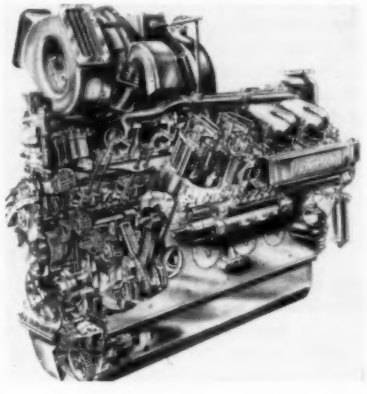
Large bore swivel valves for off-highway tube or tubeless tire installations are now available with one valve extension stem assembly. Interchangeability is an automatic feature of the valve extension assembly. The manufacturer reports that this feature simplifies maintenance and service of off-highway tire mounting. The valves are made by A. Schrader's Son, Division Scovill Manufacturing Company. Circle No. 62.





New Device Protects Against Ground Faults

New Lectronic Sentry made by Joy Manufacturing Company provides positive protection against short circuits and ground fault on any DC operated off-track mining equipment and their trailing cables. Unit consists of a transmitter (left) and receiving element (right). When the continuous monitor signal of the sender (attached to mining machine) is interrupted, the receiver (part of automatic circuit breaker at outby end of cable) acts to remove power completely from trouble-causing machine. The Sentry is said to act when a dangerous condition exists and is able to distinguish between normal conditions of overload and potentially dangerous short circuits. Circle No. 70.



V-Type Diesel Engines

Newly designed Paxman 12 or 16 cylinder Diesel engines are now available from Davey Paxman & Co. Ltd. in England. The series is designated the YJ and covers a range of 1,000 to 2,000 horsepower. A prominent feature of the new YJ series is a high power to engine weight ratio which is reportedly obtained through compact design. The new engines are particularly suitable for rail traction, mobile generator sets, mobile power units and stationary engine duties. An additional main crankshaft bearing at the driving end is provided to take the weight of driven machinery such as single bearing armature generators. Circle No. 74.

Deep Hole Drills
Drifters
Air Feed Leg Drills
Sinkers
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Chain Feeds
Screw Feeds
Hydraulic Drill Booms
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Jumbo Components
Jumbo Carriages
"Air Trac"® Crawler Drills
"Mole-Drils"*
Carburized Drill Steel
Couplings
Ring Seal Shanks
Mine Car Loaders
Columns
"Airslushers"
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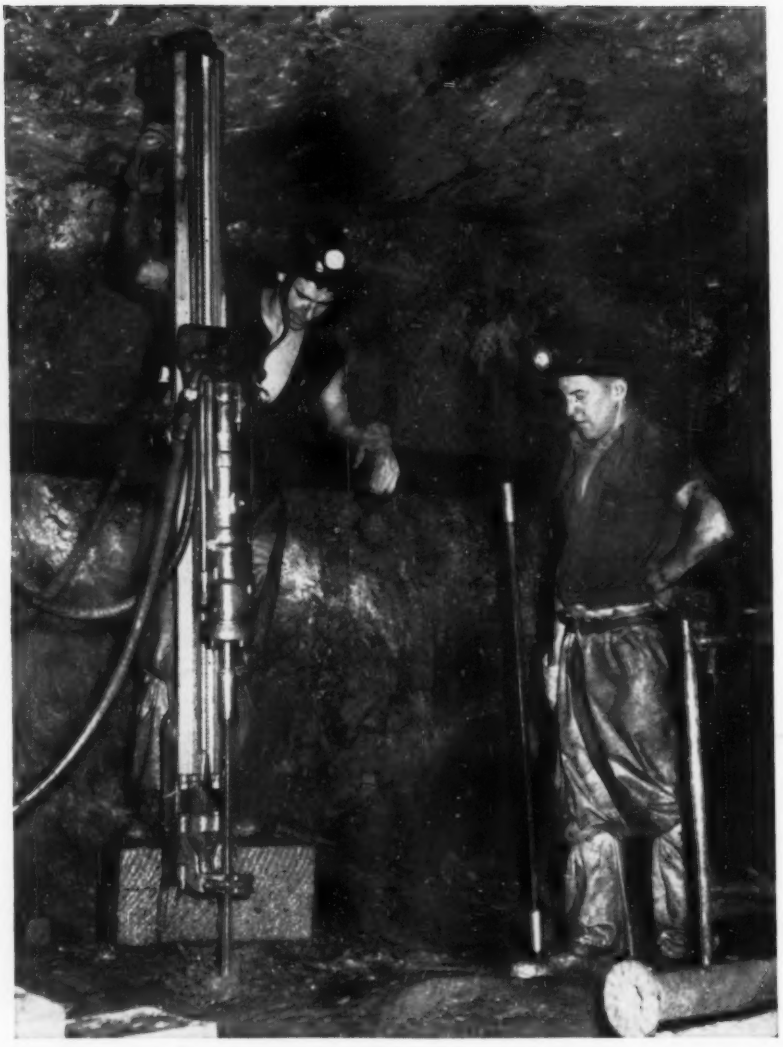
Grout Pumps
Slurry Pumps
Dewatering Pumps
Impact Wrenches
Air Maintenance Tools
Air Hoists
Bit Grinders
Oil Forges
Air Line Oilers
Drill Steel Sharpeners



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EIMCO 631 is a brand new addition to the famous 630 series of compressed-air activated, crawler mounted mucking machines. The new 631 contains a 45 cubic-foot hopper and a 5 cubic-foot bucket. The unit is self loading and capable of transporting material. It will also be available for AC operation. Circle No. 8.

ELECTRONIC WEIGHING of batch loads in trucks, mine cars, bins, chutes and hoppers is covered in a comprehensive manner in a 12-page booklet by Streeter-Amet Company. Included in the description is the theory, instrumentation and data for remote recording and/or card and ticket printing. Circle No. 17.

WIRE ROPE: Matching wire rope to the job is the subject of a new 4-page bulletin by Lesche Wire Rope Division, H. K. Porter Company. It provides specific recommendations for the best rope construction to fit various jobs. Circle No. 15.

ROCK BITS: New catalog 59 completely describes replaceable blade drill bits made by Herb J. Hawthorne, Inc. Featured is a new 4-blade carbide insert bit developed for either air or water drilling in harder formations. Circle No. 30.

V-BELT ratings of the Dayton Cog-Belt line have been increased to 200 to 300 percent of previous standard horsepower ratings according to an announcement by Dayton Industrial Products Division of Dayton Rubber Co. Circle No. 28.

SCRAPERS and rear dumps are described in a new catalog published by Euclid Division of General Motors. The 16-page folder is devoted to the model S-18 scraper of 21-yard struck capacity and the R-10 rear dump with 10-ton payload. Circle No. 10.

FUTURE GOLD PLANTS is the subject of a new bulletin published by Western Machinery Company. It deals with the close similarity in the extractive metallurgy of gold and uranium. Circle No. 13.

ELECTRICAL CONNECTORS are described in a new illustrated catalog published by Joy Manufacturing Company. Circle No. 21.

CLARIFICATION equipment made by Process Engineerings Inc., Division of The Eimco Corporation, is described in a new bulletin. Also described are Eimco-Process flash mixers and contactors and flocculation mechanisms. Circle No. 18.

FOR REPRODUCTION: A new piece of equipment made by Peerless Photo Products Inc. will enlarge opaque or translucent originals on a continuous flow basis. The new Collins-Peerless Neoflow Enlarging Camera utilizes the method of reflex photocopying. Circle No. 20.

NEW STARTER intended for fully automatic starting and stopping of engine driven generating sets has been marketed by the Automatic Switch Company. Circle No. 24.

JAW CRUSHERS made by Traylor Engineering & Mfg. Co. feature curved jaw plates employing the principle of the curved setting. For added details on this feature Circle No. 6.

SLUSHING around the corner is now practically infallible with the newly redesigned Pacific round-the-corner sheave block, reports Alloy Steel & Metals Company. Bulletin 259 gives complete details. Circle No. 9.

SCREEN PURCHASES can be simplified by reference to a 4-page folder available from Wickwire Spencer Steel Division of The Colorado Fuel & Iron Corporation. The folder describes Super-Tempered and Wisscoloy Precisions Space Screens. Circle No. 16.

REFRACTORY CEMENTS and data on mortar and coatings is contained in a new booklet published by Mexico Refractories Company. Tips on matching mortars and refractory bricks for industrial furnaces are included. Circle No. 11.

CAR SHAKER made by Stephens-Adamson Mfg. Co. is described in bulletin 658. S-A Carquake is said to provide hydraulically powered vibration with speed controlled to match required capacity. Unit is self-contained, requires no overhead structures. Circle No. 4.

HYDRA-BOOM drilling rigs for mechanized rock drilling are described by Ingersoll Rand bulletin 4196. Hydra-Booms are said to provide smooth effortless hydraulic control of all drill motions from a central console. Circle No. 5.

WOOD TANKS or pipes may prove more economical for many applications say National Tank & Pipe spokesmen. A new catalog and engineering assistance is available. Circle No. 33.

HIGH PRESSURE PUMPS made by John Bean Division, Food Machinery & Chemical Corp., are available for such applications as core drilling, de-watering and general mine pump service. Full details are obtainable from the company. Circle No. 32.

HOBART 12A ELECTRODE is designed for welding mild steel in flat, vertical or rolled positions. The new electrode, E6012 classification, has iron powder added to the coating to increase deposition rates. Circle No. 29.

JOY TC BITS with a chipway design are said to feature maximum hole cleaning ability and keep the bit drilling longer. Joy Manufacturing Co. bulletin 295-8 lists complete specifications of the company's line of tungsten carbide rock bits. Circle No. 7.

DRIVES for screw conveyors are described in a new 16-page bulletin by Dodge Manufacturing Corp. Circle No. 26.

NEW AIR FILTERS for use with all types of small air-cooled engines and air compressors have been announced by Purolator Products, Inc. Circle No. 12.

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46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70
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NEW BURNER developed by Thermal Research & Engineering Corp. pre-vaporizes oil for high heat release rates and high flue gas exit velocities. Heat release rates of high velocity oil burner are generally over 10,000,000 BTU per hour. Circle No. 43.

STOPE FILLING: Preparation and handling sand for hydraulic filling is the subject of an engineering notebook bulletin by Denver Equipment Company. Circle No. 44.

AIR CLEANERS: New dry-type air cleaners are now available for most of the larger Caterpillar wheel and track type tractors originally equipped with oil bath units. Circle No. 45.

RESUSCITATOR: Globe Industries, Inc. announces the development of a new mouth-to-mouth resuscitator. The new unit is said to be an extension of the approved mouth-to-mouth technique which has advantages over artificial respiration. Circle No. 46.

EQUIPMENT CATALOG published by Martindale Electric Company contains buying guide for metal-working saws, rotary files and burs, test instruments, safety equipment and many electrical and maintenance items. Circle No. 47.

REFRACTORY MATERIAL: A new silicon carbide offers high resistance to thermal shock and erosion, according to The Carborundum Company. "CRB" silicon carbide is said to withstand temperatures over 4,500° F. Circle No. 48.

TRANSMISSION BELTING: Nylon core belting, which is said to withstand higher running speeds and greater shock loads is described in a new bulletin by L. H. Shingle Company. Circle No. 49.

NEW CAP LAMPS made by National Mine Service are said to provide 30 percent increase in light at no increase in weight. Another new feature of the Wheat National cap lamp: fingertip focusing to a perfect spot. Circle No. 51.

DIPPER TEETH: New guide to selection of the new Simplex two-part tooth made by American Manganese Steel Division is contained in a 16-page catalog. Over 400 tooth point and tooth adapter models are listed. Circle No. 52.

FOR SKIN IRRITANTS: Three new creams are available from Mine Safety Appliances to protect against soluble and insoluble irritants. Circle No. 53.

NEW DIESEL: International Harvester Company's new UDT 817 turbotorque engine is described as the most powerful in International's line. It develops 385 horsepower at 2,100 rpm. Circle No. 55.

DRILL HOLE SURVEYS: New kit made by Exploration Methods, Inc. of Ishpeming contains Mass compass and a goniometer plus necessary accessories for testing inclination and direction of drill holes. Circle No. 54.

FILTER FABRICS: New 8-page bulletin describes products, services, facilities of filter fabric sales and engineering company. Published by Technical Fabricators Inc., it can be obtained by circling No. 56.

MINE TRACK: Bethlehem Steel Company has recently made available a new catalog of mine and industrial trackwork. Catalog 470 is comprehensive and may be obtained by writing the Publications Department, Bethlehem Steel Company, Bethlehem, Pa. Circle No. 57.

ELECTRIC SLUSHERS: Details of a new line of Vulcan-Denver slushers, that feature clutch tracks which provide better heat dissipation and fully sealed planetary housings, are outlined in a new bulletin by Vulcan Iron Works Co. Other new features: lubricant reservoirs ample for a year of operation and self energizing clutches. Circle No. 41.

AIR STARTERS: New bulletin by Ingersoll Rand Company contains case histories of air starting motor installations for internal combustion engines. Circle No. 42.

4-in-1 SKID SHOVEL: Features are graphically depicted in a new catalog by International Harvester Co. The new International Drott TD-15 provides four prime construction units in one tractor loader. Circle No. 19.

SOLIDS PUMP made by Morris Machine Works is described in a new bulletin No. 189. The model CK pump was designed for heavy duty slurry service and can handle fluids containing random size solids and highly abrasive material. It is effective for dredging operations. Circle No. 22.

V-BELT bulletin has been published by Flexible Steel Lacing Company. The bulletin offers information on the use of fasteners with open-end V-belting and tables on how to determine belt length. Circle No. 23.

FORK LIFT TRUCK has been developed by Getman Brothers and is now available throughout the United States. It is designed to work outdoors and indoors. Lifting capacity: 2,000 pounds. Circle No. 14.

NEW ROTARY DRILL for depths to 250 feet is available from Arrow Manufacturing Company. The unit is compact, portable and small. Power is transferred to the drill from a separate engine through flexible hoses and a fluid transmission. Circle No. 25.

ENGINEERING DESIGN, consultation and construction are three services offered by O. W. Walvoord, Inc. These services are developed in a new 4-page bulletin. Circle No. 27.

NEW BULLETIN has been issued on the Gyra-San process, designed to disintegrate clays, stick and loosely cemented materials. This scrubber is made by Enterprise Machinery Corporation. Circle No. 14.

LOADERS & DOZERS in the Eimco 105 series of tractors are described in a new 16-page booklet available from The Eimco Corporation. Circle No. 31.

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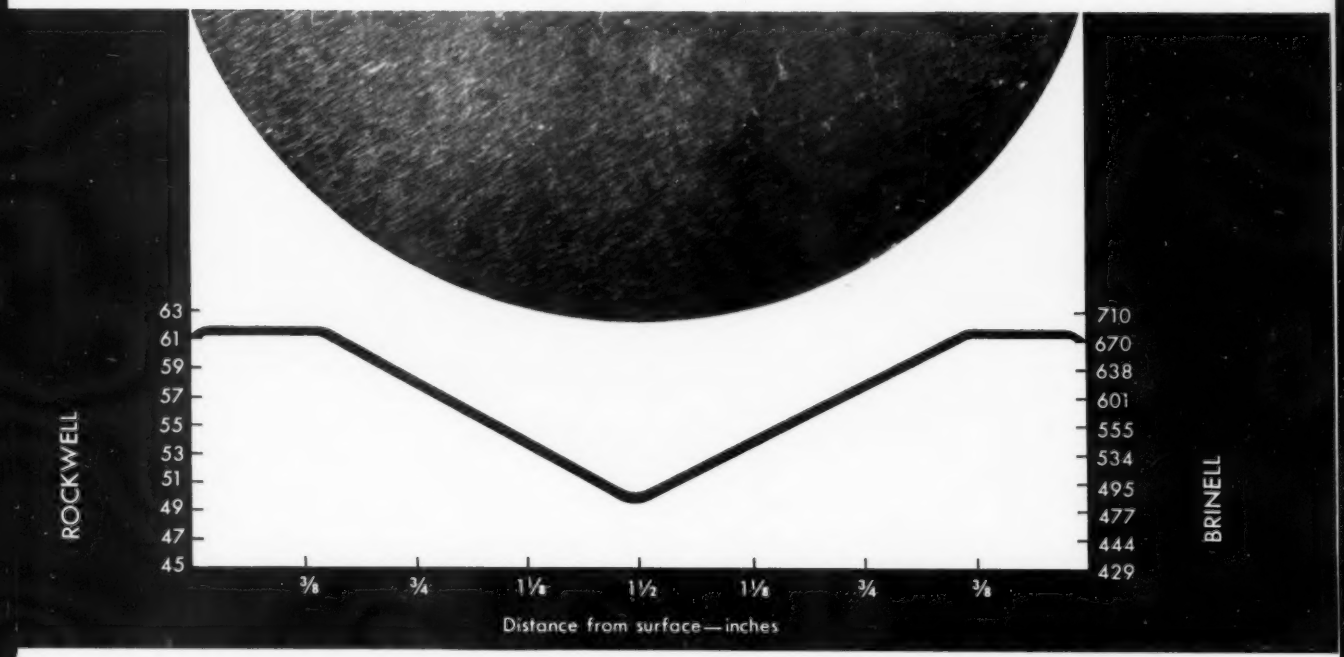
controlled metal hardness means

heat-treated cast alloy steel

NACO GRINDING BALLS

cut per-ton grinding costs



Note how new casting process and full heat treatment show controlled hardness between surface and inner core.

Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

Structurally, they possess a grain closely approaching tool steel—tough, hard and rugged for long lasting qualities. Laboratory tests show a remarkable uniformity in solidity, both under X-ray and specific gravity tests, with controlled hardness holding to a desired depth.

AA-5059

CAPITOL FOUNDRY DIVISION

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

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"Our blasting days are over

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. . . . . with the TD-24"

—Wrightwood White Rock Co.,

Wrightwood, California

"With the International TD-24 our need for explosives to shatter rock is eliminated," declares Owner Dale Douce, Wrightwood White Rock Co. "The '24' can do a better job than dynamite at a fraction of the cost."

The TD-24 removes a 40-foot overburden from the 1,000-foot-thick deposit—rips the rock into fragments, dozes it down to the loading level.

It's typical of the tough rock jobs which so many miners and quarrymen are doing to best advantage with Planet Power-steered TD-24's—against any other method or machine!

How TD-24's double for dynamite Sometimes it even takes two king-sized, clutch-steered crawlers to equal one Planet Power-steered TD-24 on rough, tough rock-moving. Exclusive, years-proved Planet Power steering gives your operator full-time "live" power on both TD-24 tracks—full-time separate and positive control of each track! And full-time, on-the-go Hi-Lo (up or down!) power-shifting.

Load-limiting and load-spilling "dead-track drag" is eliminated, because Planet Power steering keeps the full payload on the move even on turns. Gives bonus-load follow-through when ripping or dozing rock. Equalizes track speed for full-bite benching!

Prove the amazing production increase Planet Power-steered TD-24's can give and keep giving you—"blasting" through rock or other tough materials—or on everyday overburden removal. Compare TD-24 undercarriage strength—long, heavy-duty track-roller life and maintenance ease—precision sealing of parts—to anything else on tracks! See your International Construction Equipment Distributor for a demonstration!

"I always feel confident in the big TD-24, even working on the edge of benches with a sheer 100-foot drop," reports Operator Lloyd Medlock. "Positive steering control, good brakes and excellent balance make the TD-24 a *safe* tractor even in hazardous work like ours."

This quarry produces an exceptionally white, high-calcium (98%) limestone—widely used for roof-covering in the Los Angeles area; also by glass and chemical manufacturers. Note the rock-shattering job being done by the TD-24-powered Ateco ripper!

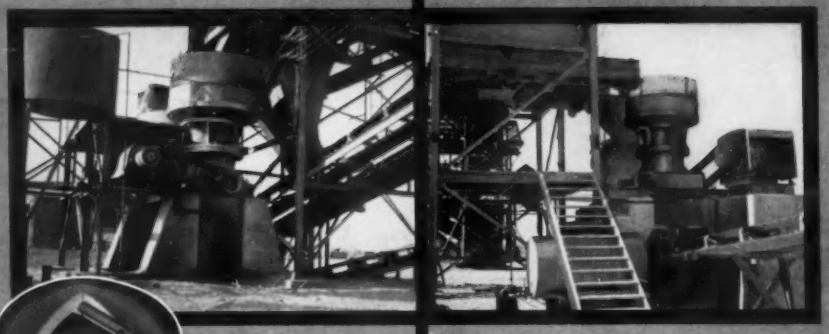
International® Construction Equipment

International Harvester Co., 180 North Michigan Avenue

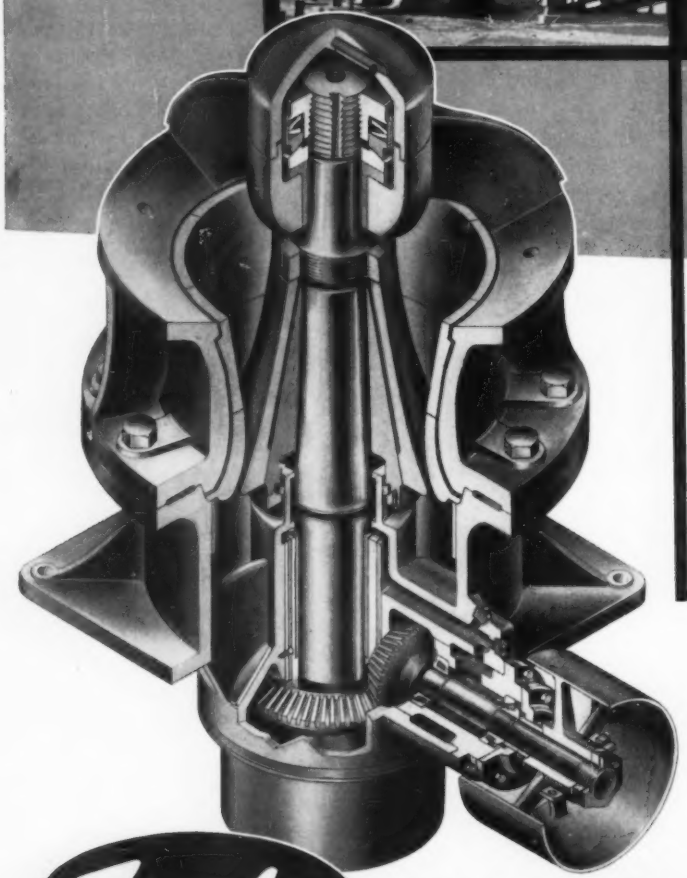
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

type **TY** gyratory crusher

for secondary reduction



Shown at left is a 3'-0" Traylor Crusher in a rock and gravel producing plant. Above - 2'-4" TY Crusher in operation at sand and gravel plant.



Traylor TY Secondary Crushers feature many original Traylor developments. Among them are the famous self-tightening bell head, curved concaves of manganese steel, and the patented Traylor dust seal that excludes dust and grit from the lubrication chamber. You buy many outstanding features when you buy Traylor — famous the world over for fine crushing machinery. Write for Bulletin No. 8112 today!

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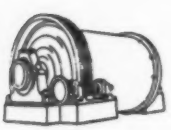
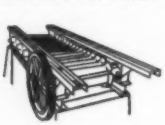


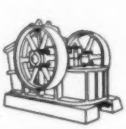
BALL MILLS

ROTARY KILNS



APRON FEEDERS

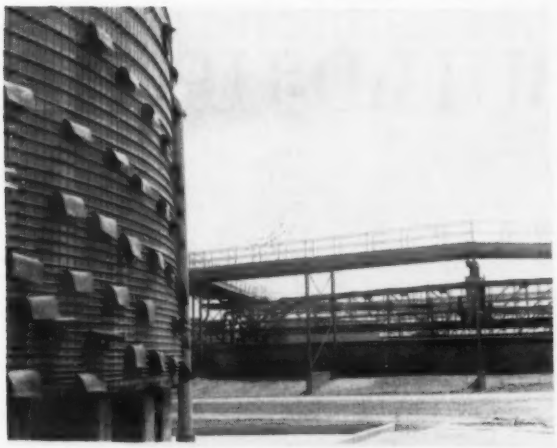
PRIMARY GYRATORY CRUSHERS



JAW CRUSHERS

SECONDARY GYRATORY CRUSHERS

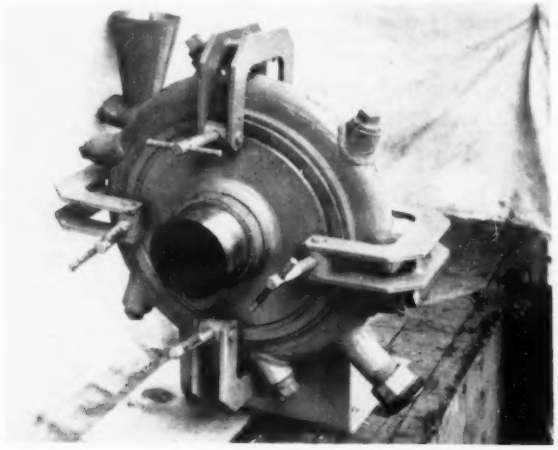
Money Making Methods



Polyethylene Prevents Acid Damage

Acid leach tanks and agitators do run over, despite mechanical and human alarms and shut off valves. When they do, the acid eats right into the threads on the bolts and nuts joining the steel rings which hold the wooden stave tanks together.

To prevent such acid damage, Kermac Nuclear Fuel Corporation uses a thin sheet of naturally acid proof polyethylene to cover each thread and bolt at its new Ambrosia Lake uranium mill. A sheet is looped over each thread as the tank is erected and is held firmly in place against the tank as the rings are tightened. These sheets divert spills.



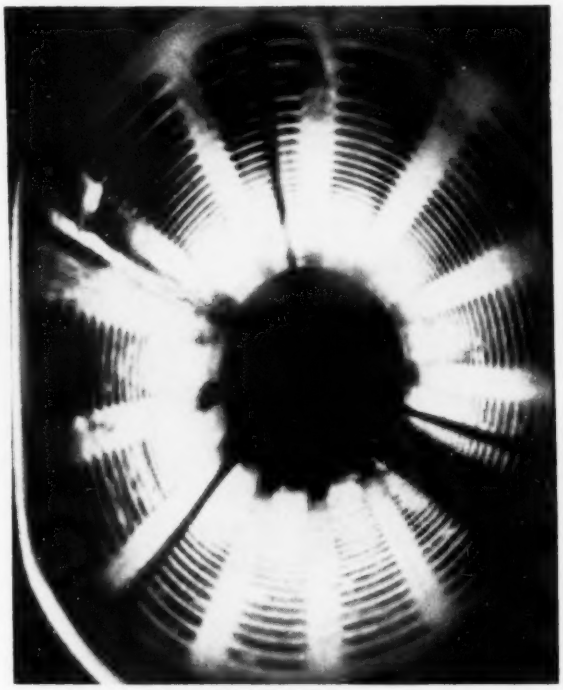
ULTRA FINE PULVERIZATION mill achieves super speed rotation of particles by opposing tangential jets of air or steam.

No Moving Parts in Fine Grinding Mill

Commercially available in 4- to 15-inch diameters from the Sturtevant Mill Company are new tungsten carbide lined micronizers for grinding abrasive materials.

Ore samples, metallurgical products, and other material can now be reduced to several micron size without attritional heat, without damage or wear to grinding unit, or contamination of the feed.

The new machines open new fields of ultra fine grinding.



UNDERGROUND UNDERWATER TV PICTURE taken at the bottom of a drill hole and transmitted to continuous monitor at collar. The picture shows setting of new type of louvered screen.

TV Down The Hole Gives Ore Clues

What does the ore look like in the bottom of your drill hole? Does the ore zone have a flow of water in it? What is the position of the broken drill bit in the bottom of your drill hole?

Now you can see for yourself and get the answers to these and many other questions immediately by using the new closed circuit underwater television camera developed by Layne and Bowler Pump Company of Los Angeles.

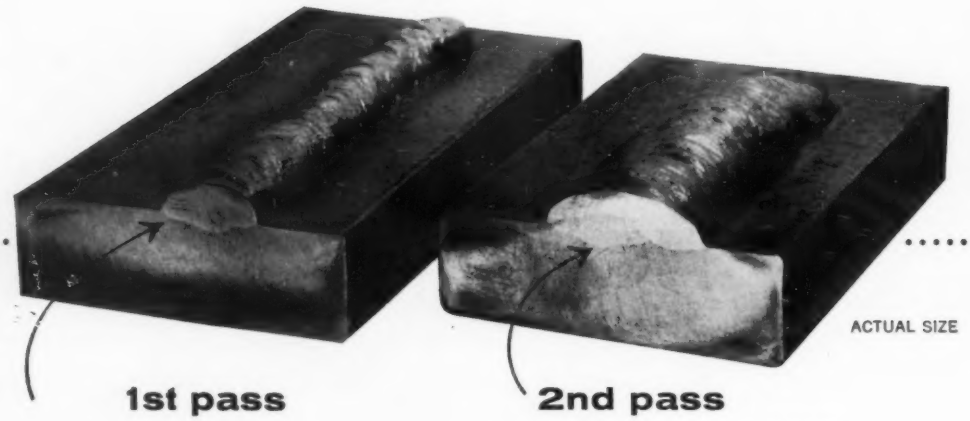
The new round camera is less than four inches in diameter, 20 inches long, and weighs only 12.5 pounds. It carries its own lighting system as it is lowered down your drill hole so that you can get a clear continuous picture of the walls of the hole. Two sets of lights are available. One uses a small ring of lights behind the camera lens, while another uses a single high intensity mercury vapor light ahead of the camera with a shield between it and the lens. The TV camera uses a standard, 16 millimeter, wide-angle focusing lens.

The sweep circuits for the camera are contained in the monitor (receiver) at the collar of the hole and carried to the camera through the multi-conductor suspension system. The closed circuit TV produces better than broadcast quality pictures. A permanent record of the hole can be made by photographing the picture on the receiver.

To date, the equipment will not send and receive colored pictures, but it is believed that this can be done in the early future. Temperature limitation at present is 140° F., but this problem can be overcome by insulation and refrigeration units in the case as is now done in the missile field. The equipment is built for use under pressure of less than 1,500 feet of water, but higher pressure units can be built.

STOODY BUILD-UP

(Iron Powder Coating)



Compare the new Stoody Build-Up with any other material of this type. It gives you:

SPEED.....15% to 50% faster deposit rate

BUILD-UP.....Higher—with sound deposits

ECONOMY.....High welding efficiency gives lower cost per pound of deposit

WELDABILITY.....Stable arc—low spatter—less smoke

OTHER FEATURES....Higher tensile strength—low crack sensitivity—excellent machinability

Use Stoody Build-Up for

- Shafts (to be machined)
- Gear Teeth
- Sprockets
- Tractor Rails
- Churn Drills
- Build-up on carbon steels for hard-facing overlay

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STOODY COMPANY

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United States

Personalities in the News——

H. J. LONGMORE was recently elected vice president in charge of sales at Sprague and Henwood, Inc., Scranton, Pennsylvania. Mr. Longmore has been associated with Sprague and Henwood for over 34 years—many of which have been in the capacities of secretary and sales manager. Mr. Longmore is also executive vice president of Sprague and Henwood International Corporation, and secretary of Rotary Drilling Equipment Incorporated.

Phillips Petroleum Company recently announced several personnel changes at the Grants, New Mexico operations. **A. A. Ruoho,** former Ambrosio Lake mill and general superintendent, was appointed Grants district manager for the enlarged mining and milling organization. **W. O. Bice,** former process superintendent, became Ambrosia mill superintendent. **G. E. Karr** was appointed assistant manager, administrative, for the Grants district, and **D. C. Arnold** became Grants district geologist.

Recent appointments in the newly created Western District of Oliver Iron Mining Division, United States Steel, include the following: **M. R. Sermon,** chief mining engineer; **L. E. Battles** and **R. R. Wallace,** assistant chief mining engineers of the Canisteo and Hibbing Districts respectively; **A. E. Hermann,** superintendent of industrial relations; **C. R. Lothrop,** assistant superintendent of industrial relations; **W. D. Carlson,** chief accountant; **G. W. Coad,** assistant chief accountant; **W. C. Bubany,** assistant to the chief accountant; **J. H. Schoenig,** superintendent of maintenance; **R. N. McIndoo** and **K. L. Prothero,** assistant superintendents; **W. E. Holliday,** chief chemist; **M. O. Carlson** and **L. A. Danielson,** assistant chief chemists; **E. O. Larson,** supervisor of supplies; **C. N. Goggins,** assistant superintendent of supplies; **E. G. Gersich,** safety supervisor; **D. G. Rukavina,** safety engineer for the Canisteo area; **J. J. Kerr, Jr.,** captain of plant protection; and **J. B. Sundquist,** district industrial engineer. All operations will be directed from the Hibbing, Minnesota office under **J. H. Hearding,** general superintendent, and **M. E. Johnson,** assistant general superintendent.

Fred W. Droston, former reactor engineer with the U. S. Atomic Energy Commission's Oak Ridge operations office, has been named director of Metallurgical Development for Heavy Minerals Company, a subsidiary of Vitro Corporation of America, at Chattanooga, Tennessee. Mr. Drosten, a chemical engineering graduate of Washington University in St. Louis, Missouri, was a section head with the development staff of Cramet Inc., in Chattanooga, prior to his work in reactor research at Oak Ridge.

OSCAR S. STRAUS has recently become a partner in the mining and metallurgical firm of Guggenheim Brothers, New York. Mr. Straus, former chairman of the finance committee of American Smelting and Refining Company, will be in charge of new projects, exploration and development for Guggenheim Brothers. In the announcement of Mr. Straus' partnership, Mr. Harry Guggenheim said the firm intends to "seek new projects in the field of exploration for the products of nature that are useful to man." For the present, operations will be confined, he said, to the United States, Canada, and certain countries of Latin America.

FRANK COOLBAUGH, left, has recently been appointed president, Climax Molybdenum Company, a division of American Metal Climax, Inc. Mr. Coolbaugh began his career with the company as a miner's helper at Climax, Colorado after graduation from the Colorado School of Mines. After service with the Army Corps of Engineers during World War II, he returned to Climax where he continued his steady advancement at the Climax mine. In 1957, he was made a vice president and director. Mr. Coolbaugh will make his headquarters in New York City. Replacing Mr. Coolbaugh as general manager of Climax's Western Operations is ROBERT HENDERSON, who will move from Climax to Golden, Colorado to establish headquarters.

Frank L. Magee, president of the Aluminum company of America, has been named chief executive officer of the company. Other advancements include **M. M. Anderson, Leon E. Hickman,** and **Lawrence L. Litchfield, Jr.** to executive vice presidents; and **Theodore W. Bossert** and **Robert A. Learnard** to vice presidents.

Roman Chelminski has joined Singmaster & Breyer, New York metallurgical and chemical process engineers, as an associate. He has previously been a senior partner of Knowles Associates for 12 years. Mr. Chelminski was responsible for the design of such projects as the Uranium Reduction Company mill at Moab, Utah.

David Rice, assistant mine superintendent, has been promoted to mine superintendent for Potash Company of American operations in New Mexico. Mr. Rice succeeds **R. R. Knill,** who has been advanced to general superintendent.

BUCK KIEL, manager of milling for Kermac Nuclear Fuel Corporation's mills in New Mexico, was erroneously listed as being maintenance superintendent on page 50 of the June issue of MINING WORLD. Prior to joining Kermac he was mill superintendent for Golden Cycle Corporation's gold mill at Cripple Creek, Colorado. He holds a metallurgical engineer's degree from the Colorado School of Mines.

Darrel T. Young has been promoted to electrical engineer, engineering department, Western Mining Divisions, Kennecott Copper Corporation.

Grover J. Holt, assistant to the president of Cleveland-Cliffs Iron Company was awarded an honorary degree of Doctor of Engineering from the University of North Dakota during the school's 75th anniversary celebration.

David Victor has been promoted to assistant chief engineer at the White Pine Copper Company's White Pine mine in Michigan.

James L. Stevens, quality control director for Kennecott Copper Corporation's Ray Mines Division, Hayden, Arizona, has retired after more then 36 years' service with the property. Mr. Stevens, who served as mill superintendent at the Hayden mill from 1951 until 1957, is known throughout the industry for his research work in the development of the reagent raconite, which is still a basic reagent in the mill's flotation section.

Louis Ware, chairman of the board of directors of International Minerals and Chemical Corporation, and the phosphate industry of Polk County, Florida were recently honored at a community dinner in Lakeland, Florida. This dinner culminated the observance by the Lakeland community of "Phosphate Day."

EDWARD I. RENOUARD of Butte, Montana has been elected vice president in charge of western operations of The Anaconda Company. He has been manager of mines since 1952. A native of Butte and son of one of the pioneers of the mining camp, Mr. Renouard graduated from the Montana School of Mines. Moving up to his present position, he has been a hard-rock miner, shift boss, sampler, safety inspector, assistant mine foreman, foreman, assistant general and general superintendent of mines. He became general superintendent of mines in 1951, a position he held until elevated to the post of manager of mines the following year.

The makers of ***THE BIG E*** *announce . . .*

ANOTHER ADVANCED DESIGN SERIES OF MODERN TRACTORS AND TRACTOR UNITS

the EIMCO 103

NEW Power! NEW Maneuverability! NEW Unitized Construction!

The Eimco Corporation, pioneer in MODERN Tractor engineering and design, now brings you the **first modern tractor** specifically engineered to fill your size, power and work needs in the medium size tractor field **. . . the 103 series!**

Eimco 103 — Tractor only
Eimco 103 — with Dozer attachments
Eimco 123 — Efficient Front End Loader
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Eimco 143 — Log Loader

LOOK AT THESE FEATURES . . .

100 horsepower . . . General Motors or Cummins Diesel Engines of latest modern design.

Quadra-Torque . . . the new modern power team with four forward and four reverse gears. Permits shifts from any gear, forward or reverse, to any other, at any tractor or engine speed without slowing or stopping the tractor.

Unidrive and Dual Final Drives . . . Eimco engineered and built, with independent track operations for smooth, safe spin turns without track-drag. Simple, reliable, powerful!

Up to 33,000 lbs. drawbar pull . . . with adequate traction, through the Quadra-Torque-Unidrive-Torque Converter power team!

Unitized "Stress Flow" Construction . . . newest Eimco exclusive. Large, strong steel castings are molded to shape required, with thickness varied as required to withstand maximum stresses. Main frame, final drive and center housings one strong casting! No bolts or welds. Components readily accessible.

Up-front operator position . . . for maximum control and visibility.

Simple controls . . . with power shifting. No clutch. No stalling. Flip of a lever controls speeds, forward, reverse, insures more work output.

Just like your modern automobile, the modern Eimco makes operations easier, faster and more economical . . . automatically.

Investigate the many exclusive advantages of the New Eimco 103 line of Modern Tractors

Write for specifications on any of the units in this new, modern series of tractors. Address Dept. AN - 1 — The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah. We'll be glad to demonstrate the unit that best fits your needs right on your own job, upon receipt of a request on your letterhead.

No other machine can surpass Eimco's rugged custom-built construction. Let us demonstrate the modern Eimco 103 and the famous "Big E", the Eimco 105 Series, to you and your men. You'll agree that here are machines built for the job . . . tailor-made to fill your requirements with rugged long-life quality in every component.

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Newsmakers in International Mining

PRAKASH CHANDRA JAIN recently resigned his position as reader in mining engineering at M. B. M. College in Jodhpur, India. Mr. Jain is now associated with Messrs. Larson and Toubro, Limited in Calcutta, India, as a sales engineer in the mining division.

O. Steveni, formerly with Grootvlei Prop. Mines, Limited, is now associated with Winkelhaak Mines, Limited, at Evander, Via Kinross, Transvaal, South Africa.

Paavo Haapala, chief geologist with Outokumpu Oy of Finland, has recently moved from Otaniemi to the head offices of Kuparitalo, Helsinki, Finland. Outokumpu Oy operations are concerned with copper mining, smelting, refining, and manufacturing.

Frederick Towell, Jr., is assistant smelter superintendent at Andes Copper Mining Company in Potrerillos, Chile, and not at Braden Copper Corporation as reported on page 50 of the April 1959 MINING WORLD. Mr. Towell was recently in the Rhodesian Copperbelt of Africa to study copper smelting methods.

Richard Cooligan has been named president and director of Moa Bay Mining Company, a wholly owned subsidiary of Freeport Nickel Company. This company will operate the Cuban mine and concentrating facilities for Freeport. Mr. Cooligan has been with Freeport for 19 years and most of that time has been spent with the Cuban operations. Other officers of Moa Bay Mining Company are **Balfour F. Darnell,** vice president and general manager; **Robert L. James,** vice president-legal; **Rudolph E. Kruger,** vice president-finance; and **Daniel W. Machon,** vice president-administrative.

Arnold Wychodil, export manager of Daimler-Benz AG, West Germany, was honored recently by his associates on his 50th birthday and 23rd anniversary with the firm. He has built export sales to 45 percent of the company's business in 130 countries.

Elected officers of the Atlas Consolidated Mining and Development Corporation, Philippine Islands, are: **Andres Soriano,** president; **Jose M. Soriano, Andres Soriano, Jr., Jose E. Kelley** and **Charles Smith,** vice presidents; **Ramon J. Fernandez, Antonio Roxas, Francisco Ortigas, Jr., Ernesto D. Rufino, Alberto Guevara** and **Daniel Me. Gomez.** Other officers are **A. M. Macleod,** vice president; **Lee A. Telesco and Roy Woodruff,** assistant vice presidents, **Juan de Ibazeta,** treasurer, and **Marcelo P. Karaan,** secretary.

D. M. MacLean, mine manager at the Chibougamau operation of Campbell Chibougamau Mines in Canada, has been appointed to the position of chief engineer. He will make his headquarters at the executive office of the company in Toronto, Ontario. **A. M. Walker,** former assistant mine manager, has been appointed manager and will be resident at the Dore Lake, Chibougamau district copper-gold producer.

G. L. Bateman has resigned as managing director of E. L. Bateman Ltd., Union of South Africa; however, he will remain as chairman of the board. He will be succeeded as managing director by **E. L. Bateman.**

Dick Stewart, assistant director of mining research for The Anaconda Company at Butte, Montana, recently returned from a trip to Labrador.

Samuel E. Mele, metallurgist for the Booth Company, Salt Lake City, Utah, will spend a month in Brazil working on mineral beneficiatoin, examination and development in the state of Matto Crosso.

F. L. C. Rosseel and **P. R. Wilton** have been appointed consulting engineers of Johannesburg Consolidated Investment Company Limited in Johannesburg, Union of South Africa.

Antonio Tan Kiang, president of the Surety association of the Philippines, has been elected president of Batong-Buhay Gold Mines. Other officers elected at a board of directors meeting were: **W. F. Gemperle,** vice president; **Elmer Madsen,** vice president and treasurer; **Claudio Teehankee,** director-assistant treasurer; and **Robert Dee Se Wee** and **Peter Go Pailian,** directors.

A Russian delegation, jointly sponsored by the Zinc Development Association of England and the Russian Embassy in London, recently concluded a visit to English zinc producing and consuming works. Members of the Russian delegations were: **V. Fedorov,** leader and head of non-ferrous metals section, State Scientific and Technical Committee, Moscow; **D. Derkatchev,** deputy chief, nonferrous metals section, State Planning Committee (GOSPLAN); **A. Vartanyan,** director, Ust-Kamenogorsk Zinc and Lead Combine; **M. Lakernik,** head of research on zinc and lead production, Institute of Non-Ferrous Metals, Moscow; **E. Tarassov,** engineer at thermal zinc plant, Belovo; **V. Anikeev,** galvanizing expert, National Economic Council, Chelyabinsk; and **Miss Z. Mourzaneva,** interpreter, State Scientific and Technical Committee, Moscow.

A. E. MILLAR, general manager, Yerington mine of the Anaconda Company (right) outlines oxide copper leaching to MAX GOLDICK, concentrator superintendent (left), and HAROLD WEDGWOOD, assistant manager, Roan Antelope Copper Mines Limited, Luanshya, Northern Rhodesia. Messers. Goldick and Wedgwood are visiting Anaconda's operations in Montana and Nevada, Kennecott Copper Corporation's Utah and Arizona mines and mills, as well as other Arizona mines during a month's trip to the United States.

ROBERT C. BACON has been named superintendent of operations of Braden Copper Company in Chile. A graduate of the University of Arizona, Mr. Bacon was formerly vice president of Ventures, Limited; assistant to the manager, Rosenshine interests in Peru; and mine superintendent at Vanadium Corporation of America in Colorado. He also has been associated with Cerro de Pasco Corporation and W. R. Grace & Company in Peru, C. F. Braun & Company, New York, and with the South American Development Company in Ecuador. Altogether Mr. Bacon has spent some 20 years in Latin America.

Vincent Ward, previously associated with Vaal Reefs Exploration and Mining Company of South Africa, is now concentrator superintendent at Bancroft Mines, Bancroft, Northern Rhodesia.

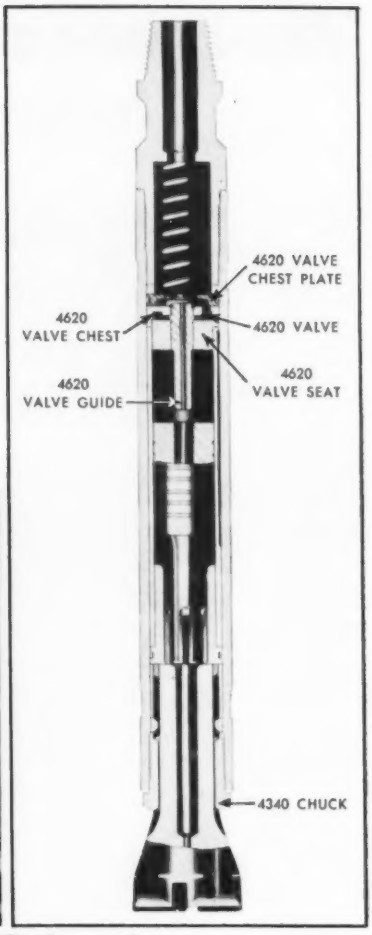
Howell L. H. Miaw, formerly associated with Mineracao Wah Chang, S.A., at Grande do Norto, Brazil, is now at Wah Chang's Aguas do Araxa, M.G., Brazil operations.

Thomas Archibald Stone has been named special assistant to the president of The International Nickel Company of Canada, Limited. Mr. Stone, Canadian Ambassador to the Netherlands from 1952 until the end of 1958, has resigned from the Department of External Affairs at Ottawa, Canada. In his new association with International Nickel, Mr. Stone will also serve as special assistant to the president of the company's United States subsidiary, The International Nickel Company, Inc. He will have his headquarters at that company's office in New York City.

Dr. Armine F. Banfield, of Behre Dolbear & Company, has returned to New York from Teheran, Iran after the completion of a report on a mineral reconnaissance of a large area in the Kerman Region in Southern Iran. Field work was started in 1958 by Dr. Banfield and **Vinton H. Clarke** of the firm.

R. G. Weavind, director of research at the Diamond Research Laboratory, Johannesburg, South Africa, was recently in the United States to present a technical paper titled "Factors Affecting the Efficiency of Resin-bonded Diamond Grinding Wheels," at the Industrial Diamond Association of America's annual meeting.

John J. McKay, formerly with Sunro Mines, Ltd. at River Jordan, British Columbia, Canada, is now development superintendent at Duncan Lake Mine of C.M.&S. Company of Canada, Ltd., at Kaslo, British Columbia.



The drill goes right down the hole with the bit in this Ingersoll-Rand percussion drill. The piston strikes the bit shank directly, with 1,000 blows per minute.

I-R Downhole drill gives "all-rock" versatility with rugged nickel alloy steels

Ingersoll-Rand is putting nickel alloy steels to work in one of the toughest mining and quarrying applications – drilling. Each Downhole drill has parts made of nickel-containing steel . . . parts that require high strength, toughness and hardness to stand up under equipment-wrecking conditions.

In mile after mile of hole – in every drillable rock – the Downhole drill has proved itself with these nickel alloy steels:

Tough, Hard 4620 Nickel-Molybdenum Steel – a truly ideal alloy for the air valve, seat, guide, chest and chest plate. This steel, when carburized, develops a good hard case with a bonus in core toughness and impact resistance . . . and it exhibits minimum distortion in heat treatment. This is especially important where critical tolerances are involved.

Strong 4340 Nickel-Chromium-Molybdenum Steel is used for one of the most critical parts – the chuck. Where the combination of high strength and toughness becomes crucial, nothing matches oil quenched and tempered 4340.

Ingersoll-Rand knows that nickel alloy steels provide the superior properties needed to keep mining and quarrying equipment operating day after day with a minimum of repairs. If you have metal parts that don't stand up, why not let nickel alloy steels prove their worth to you?

These two nickel alloy steels are carried by Steel Service Centers from coast to coast. For a list of sources, for information that will help you with your metal problems, write Inco.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

Ambrosia Lake

Continued from page 38

to passing wheels which makes holes and gullies. Closely spaced plank flooring is used to obtain a better road bed. Crushed rock is also added for a better roadway. At many mines the fine material washes out, the area dries up, and the sand bottom becomes stabilized.

Two methods are used for surface drying of wet ore. Each depends on the moisture content. For ores containing 12 to about 20 percent water, drying on the sides of stockpiles has been successful. By trucking this type of ore to top of stockpiles and dumping over the sides, the ore is spread out; as it cascades down the face of the dump, it tends to pick up and mix with the dry surface layer. The big disadvantage is the tying up of ore in the stockpile.

For wet ore, with a 20 percent plus water content, that actually flows, drying is more difficult. Initially, it is trucked to dumping areas around the shaft and spilled from the rising bed of a dumping truck to spread over the surface. After several days it is picked up by a dragline equipped with a clam shell bucket and placed in windrows. Alternately a bull dozer is used for windrowing. At times restacking is necessary to speed drying.

Mining Trends and Costs

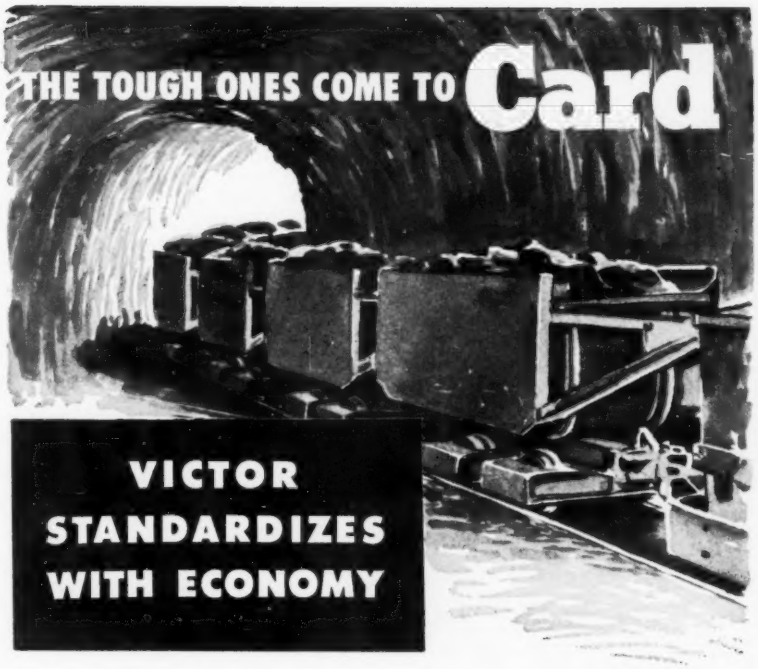
Now that ore is being mined in ever increasing tonnages as mines are developed and additional working faces become available, more attention will be given to cutting costs. The uranium milling stretch-out from 1962 to 1966 takes some of the speed-at-any-cost element out of mining, too. The big mills will continue to take all the ore that can be mined for a long time, but the mines will be in better shape to produce it.

There is a trend toward fast sublevel development with tracks to get under the ore and drain it ahead of mining. While this development is in waste, the ultimate result will be better, cleaner, easier mining at lower cost.

Equipment is getting better, too, which is cutting costs. Miners are learning how to keep water out of ore passes, how to drill drainage holes, and how to handle wet ore, all of which save money.

The value and importance of extra deep shafts below main levels, the value and increasing practice of preventative maintenance are important, too.

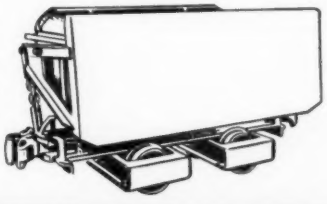
Ambrosia Lake is a great mining camp. Problems have been tough, but the accomplishments have been important. END



The Maiden Rock Mine of Victor Chemical Works first started using Card cars in 1950. Chosen design was a Granby type car of 57 cu. ft. capacity built on 24" gauge and featuring coil spring suspension. The phosphate rock being handled is relatively clean to handle, and the car design is unusually well suited. As a result, not a single Card car has ever had any significant repairs although some wheels have been replaced. Fifty-two of these cars are now in service, representing several re-orders over a four-year period.

Much of the haulage at Maiden Rock is underground, and many of these Card cars seldom see the light of day. The steady day in, day out service record of the cars has meant high production with remarkable economy for Victor—one of the three largest producers of elemental phosphorus.

Standardize your haulage with an economical Card design. Our engineers can furnish an efficient car to meet your most difficult specifications.



C.S. Card Iron Works Co.
2501 WEST 16TH AVE.
DENVER, COLORADO

Put the PRO in Your Process Plant Design

For progressive design, for professional engineering services, and for a profitable operating plant, Stearns-Roger is the logical one-source answer. Over 70 years experience in the design and construction of metallurgical, mineral and chemical beneficiation plants, small and large, assurance that for you, too, Stearns-Roger can design to your flowsheet, engineer, fabricate, and erect a modern processing plant.

COPPER
URANIUM
VANADIUM
MOLYBDENUM
LEAD-ZINC
ALUMINUM
COBALT
MAGNESIUM
MANGANESE
IRON
GOLD-SILVER
RARE METALS
POTASH
SULPHUR
PHOSPHATE
FLUORSPAR
CEMENT

Stearns-Roger

THE STEARNS-ROGER MFG. CO. • DENVER, COLORADO

Denver • Houston • El Paso • Salt Lake City

Stearns-Roger Engineering Company, Ltd., Calgary

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

Your best choice for stripping overburden

YOU get fast, lowest-cost removal of shallow, non-rocky overburden, when you use LeTourneau-Westinghouse Tournapull scrapers. Here is why:

Exclusive Tournapull advantages, such as fast-loading bowl, easy-to-operate electric controls, ground-gripping traction through power-transfer differential, and excellent maneuverability, greatly increase work output. In addition, Tournapulls have the high speeds necessary to haul waste economically to out-of-the-way disposal areas.

Interchangeable Rear-Dump

Another important advantage of Tournapulls is the fact that they need not be side-lined when stripping jobs are completed. You simply interchange the scraper for a Rear-Dump trailing unit, available at about one-fourth the cost of original machine, and work the unit as an ore or rock hauler. With Tournapulls you get year-around productivity for greater profit.

Low operating costs

LeTourneau-Westinghouse scrapers and rear-dumps also reduce your equipment maintenance costs. Tournapulls have a completely sealed, 100% antifriction drive, completely weatherproof electric-control system. And Tournapull's giant air brakes last longer, require fewer adjustments. In the event you need parts or repairs, you can depend upon the LeTourneau-Westinghouse Distributor in your area for prompt and efficient service.

A size to fit your needs

Ask for complete information on the 6.8 m^3 (9 yd^3), 13.7 m^3 (18 yd^3) or 21.4 m^3 (28 yd^3) Tournapull scraper. Interchangeable rear-dumps are available in 10, 20, and 31¾ metric ton sizes.

Stripping overburden at sand pit near Paris, France, C Tournapull with 13.7 m^3 (18 yd^3) Fullpak scraper packs in big load of earth. This machine, with two other Tournapulls, is removing 8' of overburden or 100,000 m^3 (76,460 yd^3) for their owner, Parachini, of Boissy Le Cutte.

Tournapull—Trademark Reg. U.S. Pat. Off. CP-2083-Q-Im

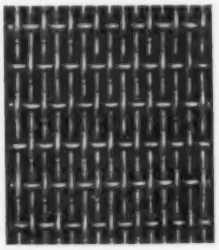
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

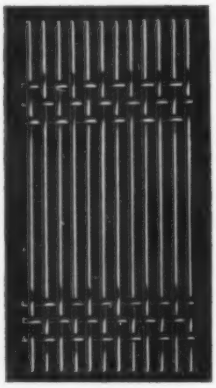
Where quality is a habit

Tournapull Rear-Dump hauls 20 metric-ton load of calcaire rock down 7% grade to cement plant. Tournapulls have big multi-disc air brakes on all 4 wheels, with up to *4 times more braking power than* automotive-type brakes found on trucks. A soft touch on the brake pedal

When you order screens, be sure to specify the type which best meets your requirements. For example:



For maximum through capacity, CF&I Space Screens with rectangular openings are recommended. The high percentage of open area provides considerable freedom from blinding or clogging.



For maximum freedom from blinding or clogging, CF&I Long Slot Space Screens are the most efficient construction. Because of the open area and intense vibration of wires on the long sides of the openings, material can not cling or build up.

* * *

Whatever your screening operation, our engineers will be glad to help you select the optimum screen for your needs.

The Image of CF&I offers

SPACE SCREENS

for less downtime . . . long screen life . . . accurate screening

Symbol for the dependability of all CF&I steel products, the giant steelman can be relied on for tough, precision space screens.

CF&I Space Screens are ideal for rugged screening operations because they are made from quality steel, and are available in a wide selection of types, weaves, crimps and edge preparations. They give long service and, consequently, fewer work stoppages and greater tonnage output for your screen dollars. CF&I Space Screens are tightly woven to retain uniform spacing and openings, thus assuring accuracy under the most demanding screening conditions.

For engineering assistance in choosing the right space screen for your operation, contact our nearest sales office.

CF&I SPACE SCREENS

THE COLORADO FUEL AND IRON CORPORATION

CF&I STEEL

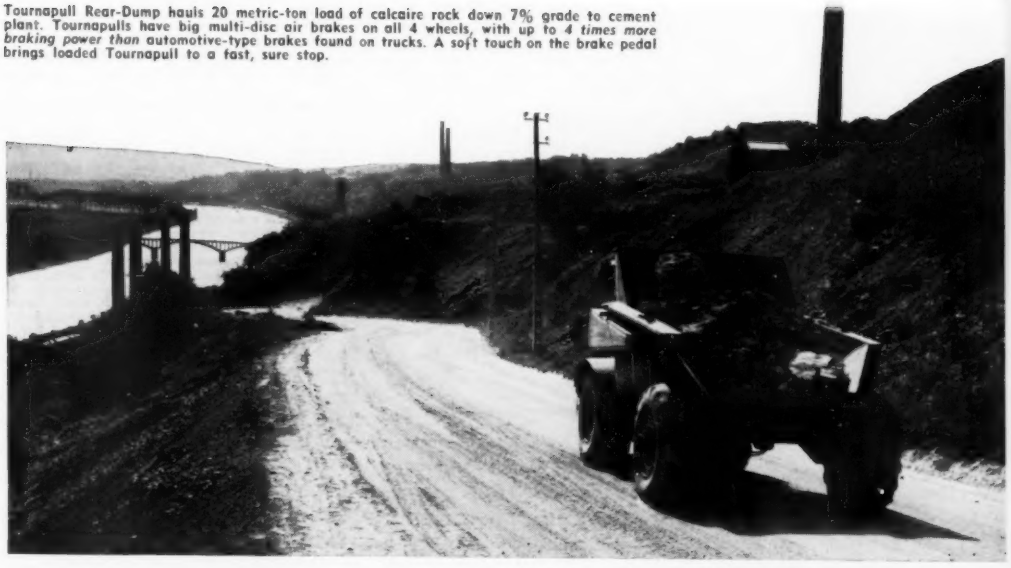
In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte Denver • El Paso • Farmington (N. M.) • Ft. Worth • Houston • Lincoln • Los Angeles • Oakland • Oklahoma City Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION**—Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans New York • Philadelphia

CF&I OFFICE IN CANADA: Montreal

CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg 6924-D

Tournapull Rear-Dump hauls 20 metric-ton load of calcaire rock down 7% grade to cement plant. Tournapulls have big multi-disc air brakes on all 4 wheels, with up to *4 times more braking power than* automotive-type brakes found on trucks. A soft touch on the brake pedal brings loaded Tournapull to a fast, sure stop.



Up and down 7% grades

2 big-braked haulers move 2,300 tons of rock per day

The Belgian firm, Carriers Dumont-Wauthier, hauls rock from its quarries to nearby cement mills. At one pit near Hermalle-Sur-Huy, the firm uses 2 LeTourneau-Westinghouse C Tournapull Rear-Dumps to move material over a 2 km (1.2 mi) up-and-downhill cycle.

Despite the 7% grade on the haul, these electric-control C Tournapulls prove to be outstanding high-production units on this job. M. Badet Armand, A.A., an official of the firm, reports these 20 metric-ton capacity Rear-Dumps haul 2,300 metric tons of calcaire rock to plant crushers each 10½-hr day.

Better safety on steep grades

On the downhill portions of each cycle, LW Rear-Dump's positive, kingpin electric-steer, big 4-wheel air brakes, and excellent traction of large low-pressure tires give the operators complete safety and control, even at high speeds. In addition to the big air brakes, Carriers Dumont-Wauthier equipped their Tournapulls with LeTourneau-Westinghouse Electrotarders, which provide extra *non-wearing* braking action. On the steepest grade, the Electrotarder can slow down a loaded Rear-Dump to a "walk," without mechanical friction or wear on the unit's regular brakes.

Write for complete facts on high-production Tournapull Rear-Dumps, available in 10, 20, and 31¾ metric-ton capacities.

A 1.8³ (2.3 cu yd) shovel drops heavy load of rock into LP Rear-Dump. Bowl is constructed with 3 layers of very strong steel to resist damage and shock of big chunk-rock dropped by excavator.

Tournapull-Trademark Reg.U.S.PatOff. CR-2075-QJ-1m

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

PACIFIC FURNACE

MULTIPLE HEARTH FURNACE

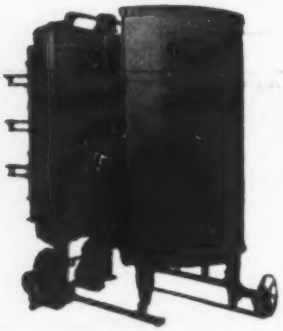
ROASTING
CALCINING
DRYING

ZINC ORES	QUICKSILVER
IRON ORES	MAGNESITE
COPPER ORES	LIMESTONE
TIN ORES	MOLYBDENUM
NICKEL ORES	BONE CHAR
LEAD ORES	DIATOMITE
SODA ASHES	LIME SLUDGE
FULLERS EARTH	MAGNESIUM
CARBON	CLAY GRANULES
PYRITE	ANTIMONY

SELENIUM
SEWAGE SLUDGE
LEAD CHEMICALS
METALLIC SLUDGES
FILTERING MEDIA

And for Numerous Other Materials

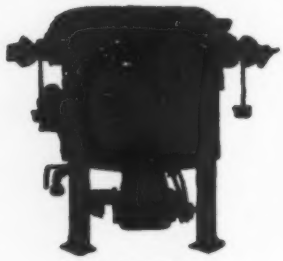
SIZES 8' 6" TO 22' 3" DIAMETER
NUMBER OF HEARTHS, 1-16



Pacific Laboratory Furnace

PACIFIC LABORATORY FURNACE

Manufactured in two sizes—36" and 54" inside diameters having 6-8-10 Hearths and include the same features as the commercial size furnace.



Pacific Furnacing Unit

NEW PACIFIC FURNACING UNIT

Higher shell height. Three gas burners. Provision for conversion to muffle unit. Small volume roasts at any desired temperature

PACIFIC FOUNDRY COMPANY, LTD.
Engineers and Metallurgists

919 South Garfield Avenue, Los Angeles 22 — 3100 19th St., San Francisco — 551 Fifth Ave., New York

U.S.A. Metal & Mineral Prices

METALS

JUNE 19, 1959

COPPER: **Electrolytic.** Delivered F.o.b. cars, Valley basis (pound) 31.50¢
Lake. Delivered, destinations, USA 31.50¢
Foreign. Delivered Destinations, USA 31.50¢
Custom 31.50¢
LEAD: **Common Grade.** New York (Per pound) 12.00¢
Tri-State Concentrate, 80% lead, per ton $134.52
ZINC: **Prime Western:** F.o.b. E. St. St. Louis (Per pound) 11.00¢
Prime Western: Delivered, New York 11.50¢
Tri-State Concentrate, 60% zinc, per ton $64.00
ALUMINUM: **Primary 30 Pound Ingots (99% plus)** (Per pound) 26.80¢
ANTIMONY: **Lone Star Brand. F.o.b. Laredo, in bulk** (Per pound) 29.50¢
BISMUTH: (In ton lots) price per pound $2.25
CADMIUM: **Sticks and bars.** 1 to 5 ton lots Price per pound 1.30
COBALT: **97.99%,** keg of 550 pounds (Price per pound) $1.75
COLUMBIUM: **Powder** Nom., per pound $55.00-$85.00
GERMANIUM: dioxide, high purity, gram 18.50¢
LITHIUM: **98%** (per pound) $11.00-$14.00
MAGNESIUM: **Ingots (99.8%)** F.o.b. Velasco, Texas, per pound 36.00¢
MERCURY: **Flasks.** Small lots, New York $240.00-$242.00
NICKEL: **"F" Ingots (5 pounds).** F.o.b. Port Colbourne, Ontario 75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay $30.00 to $40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram $30.00
SELENIUM: **99.5%, per pound** $7.00
THORIUM: per kilogram $43.00
TIN: **Grade A Brands.** New York (Per pound) Prompt delivery $1.0475
TITANIUM: **93.3%** + Grade "A" Sponge (Per pound) $1.70-$1.82
URANIUM: **Rod** (0.790 U-235) $16.00 Per Pound; Foil $16.75
U-235: **Nominal** (Per pound) $7,725
GOLD: **United States Treasury Price** $35.00 per ounce
SILVER: **Newly mined domestic.** U.S. Treasury price per ounce 90.5¢
Foreign Handy Harmon 91⅜¢
PLATINUM: Per ounce $77.00-$80.00
ZIRCONIUM: **Sponge,** Per pound, Reactor Grade $5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: **10 to 12% BeO.** F.o.b. mine, Colorado $46.00 per unit
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $48.00.
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons,
African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio $40.00-$42.00
African (Transvaal). 48% Cr_2O_3. No ratio $28.00-$30.00
Turkish, 48% CR_2O_3. 3 to 1 chrome-iron ratio Nominal $45.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal $1.00
IRON ORE: **Lake Superior. Per gross ton Lower Lake Ports**
Mesabi, Non Bessemer, 51.5% Fe $11.45
Mesabi, Bessemer, 51.5% Fe $11.60
Old Range Non Bessemer $11.70
Old Range Bessemer $11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit 25.00¢
MANGANESE ORE: **Metallurgical grade.** 48 to 50% Mn Long ton unit $1.00-$1.05
Metallurgical grade. 46 to 48% Mn. Long ton unit. $0.95-$1.05
Metallurgical grade. 44 to 46% Mn. Long ton unit $0.85-$0.90
Domestic U.S. Government. Small lot program f.o.b. railroad cars, minimum 40%. Base (48%) $2.30 per unit with premiums and penalties.
MOLYBDENITE CONCENTRATE: **90% MoS_2 F.o.b.** Climax, Colorado. Per pound Mo, plus container cost $1.25
TUNGSTEN CONCENTRATE: **Domestic.** 60% WO_3 Per short ton unit Nominal $20.00
Foreign: 65% WO_3 Per short ton unit (Scheelite) Nominal $13.00
Foreign: South American, Spanish, Portuguese Nominal $12.00
URANIUM ORE. F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is $1.50 per pound of U_3O_8 in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.

NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum **4.25 specific gravity,** per short ton $16.00
BENTONITE: **Minus-200mesh.** F.o.b. Wyoming. Per ton, carload lots $12.50
Oil Well grade. Packed in 100 pound paper bags $14.00
BORON: technical grade F.o.b. Boron California. Per ton $47.50
FLUORSPAR: **Metallurgical grade.** 72.5 % effective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines $36.00-$40.00
Mexican. 70% F.o.b. border $26.00-$27.00
Acid Grade. 97% CaF_2, Bulk, F.o.b. mine $48.00-$52.00
PERLITE: **Crude:** F.o.b. mine per short ton $3.00 to $5.00
Plaster grades. Crushed and sized. F.o.b. plants $7.00 to $9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas $25.00
Export $24.00-$25.00

LONDON METAL AND MINERAL PRICES

Per Long Ton USA Equivalent cents per pound*				June 19, 1959
COPPER:	Electrolytic spot	£288	0s 0d	28.50¢
LEAD:	Refined 99%	£ 68	17s 6d	8.61¢
ZINC:	Virgin, 98%	£ 77	5s 0d	9.66¢
ALUMINUM:	Ingot, 95.5%	£180	0s 0d	22.50¢
ANTIMONY:	Regulus, 99.6%	£197	10s 0d	24.69¢
TIN:	Standard, 97.75%	£789	0s 0d	98.63¢
TUNGSTEN:	Long ton unit	100s		$14.00
	*With Sterling		Pound at	$2.80

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

CENTRAL AND EASTERN

SEC Proposes $500,000 Limit On Non Registration

The Securities and Exchange Commission has proposed an upward limit from $300,000 to $500,000 for exemption from registration of security offerings. This is a most important proposal for the mining industry as much venture financing, including recent uranium stock sales, have been registered under the $300,000 figure. If approved, the new plan would make it possible for mining companies to obtain extra money with no additional work on their part.

The House Interstate and Commerce Foreign Committee opened hearings in Washington, D. C. on this proposal on June 3rd.

In making the proposal, SEC indicated confidence that it can detect and prosecute frauds even if no registration statements are filed for the additional class of flotations. The commission briefly described the offering circulars that must be filed by those seeking exemption and said that "the entire procedure provides a method, less expensive and time-consuming than registrations, by which issuers seeking relatively small amounts of money may sell their securities in interstate commerce without complying with the registration requirements of the Act."

Legislation which would widen the commission's power over transactions of the securities exchanges is to be proposed by SEC very shortly. The additional power is to be gained through various amendments to the Securities and Exchange Act which, in general, will apply the present law to counter dealings and to unlisted securities.

American Zinc's Reserves Up; Slab Output Down

American Zinc Company of Tennessee's zinc mines in eastern Tennessee are operating at a profit. The new Coy mine has completed initial development and is now producing at 50 percent of ultimate capacity after stoping started in January. Plans call for raising output to 70 percent of capacity by year's end. The Young mine is now producing 2,500 tons of ore daily, will be producing 3,000 tons by 1961, and is scheduled to have an ultimate mining rate of 4,000 tons per day.

Eastern Tennessee owned or optioned zinc reserves are now at an all time high of 100,000,000 tons from which 6,000,000 tons of 60 percent zinc concentrate will be recovered.

Tennessee operations were closed the last week in June so that necessary maintenance work could be carried out at the Mascot mill and underground mines.

In an attempt to stabilize the zinc market American Zinc voluntarily cut output of slab zinc 5.0 percent on July 1. This schedule will remain in effect during the last half of 1959 and for an indefinite period in 1960. On an annual basis this reduction will be between 6,000 and 7,000 tons of slab zinc.

Cerro de Pasco Corporation and **Cyprus Mines Corporation** have a joint venture exploration project underway for copper in Douglas and Bayfield counties, Wisconsin. These are the two northwesternmost counties in the state, are on the south shore of Lake Superior, and west of copper mining on the Quincy Peninsula.

St. Joseph Lead Company is making fast progress in developing its new **Viburnum** lead mine in southeastern Missouri. The flotation mill is more than ⅓ completed, one of the two main shafts is completed and level development well started, and construction of a company town is proceeding on schedule. This new Leadbelt is southwest of Flat River and was discovered by surface drilling. Ore is higher grade than at Flat River. Sinking of two shafts by the subsidiary company, **Meramec Mining Company,** at Pea Ridge has been halted by a strike.

The Missouri State Legislature has enacted into law a new Metal Mining Code. Legislation has been urged by **St. Joseph Lead Company** to keep abreast of mechanized mining and provide for deep mining when the **Meramec Mining Company's** Pea Ridge iron mine is brought into production.

Little Wolf Mining & Minerals, Inc., reports extracting a core of pitchblende from exploratory drilling on a company uranium claim east of Big Falls, Wisconsin. Drilling to 17½ foot depth revealed pitchblende veins, George Friedrich, company president, said. The firm hopes to develop the claim and construct an ore processing plant at Big Falls.

The **Michigan Conservation Department** has received permission to negotiate a proposed "all minerals" lease for wildcat exploration on state-owned lands in the western upper peninsula of Michigan. The lease proposal was introduced by **Bear Creek Mining Company,** but the department may discuss the matter with other interested companies, too. Specifically omitted from the lease area is the Porcupine Mountain State Park which was the center of much controversy last year when Bear Creek requested permission to lease it. Most of the land Bear Creek is now interested in is located in the Ottawa National Forest, where the Federal government owns the surface rights and the state owns the mineral rights. The federal agency would have to approve leasing, according to the plans of the Michigan department.

Thirty school science teachers and professional geological scientists from all parts of the country will participate in a six-week conference on the Duluth campus of the **University of Minnesota** from July 20 to August 30 to prepare improved materials for the teaching of geology in school science programs. Dr. Robert L. Heller, associate professor and head of the geology department on the Duluth campus, will be director of the conference.

Cranberry Magnetite Corporation has reopened the old **Cranberry** iron ore mine in Avery County, North Carolina and is trucking ore to Elizabethton, Tennessee for rail shipment to Rockwood, Tennessee. See item below on reopening of blast furnace at Tennessee Products & Chemical Corporation. Initial production of 100 tons of ore daily is to be increased to 300 when new equipment is installed. The mine, now owned by **Appalachian Exploration Company,** last operated in 1931. N. T. Dixon, Cranberry is company president.

After a year and half of idleness, the No. 2 blast furnace of **Tennessee Products and Chemical Corporation's** Rockwood, Tennessee, plant will resume operations. In announcing this, R. O. Baum, president, said that about seventy-five men are expected to be recalled to their former jobs of manufacturing pig iron and ferrosilicon. The recall will boost the total number of employees to 270. **Tennessee Products** obtains most of its iron ore from the Clinton iron ore formation of Silurian age. This sedimentary iron formation contains hematite that has replaced oolites and fossils. Custom ore is also purchased.

The **Tennessee Copper Company** has joined the Joseph A. Holmes Safety Association in reducing from 40 to 20 years the period that an employee must work with no-lost-time accidents to be eligible to receive a 20-year silver lapel button plus a pocketbook recognition card. A gold button is awarded after 30 years. Almost 100 men and women employees became eligible for the awards which were presented in April and May.

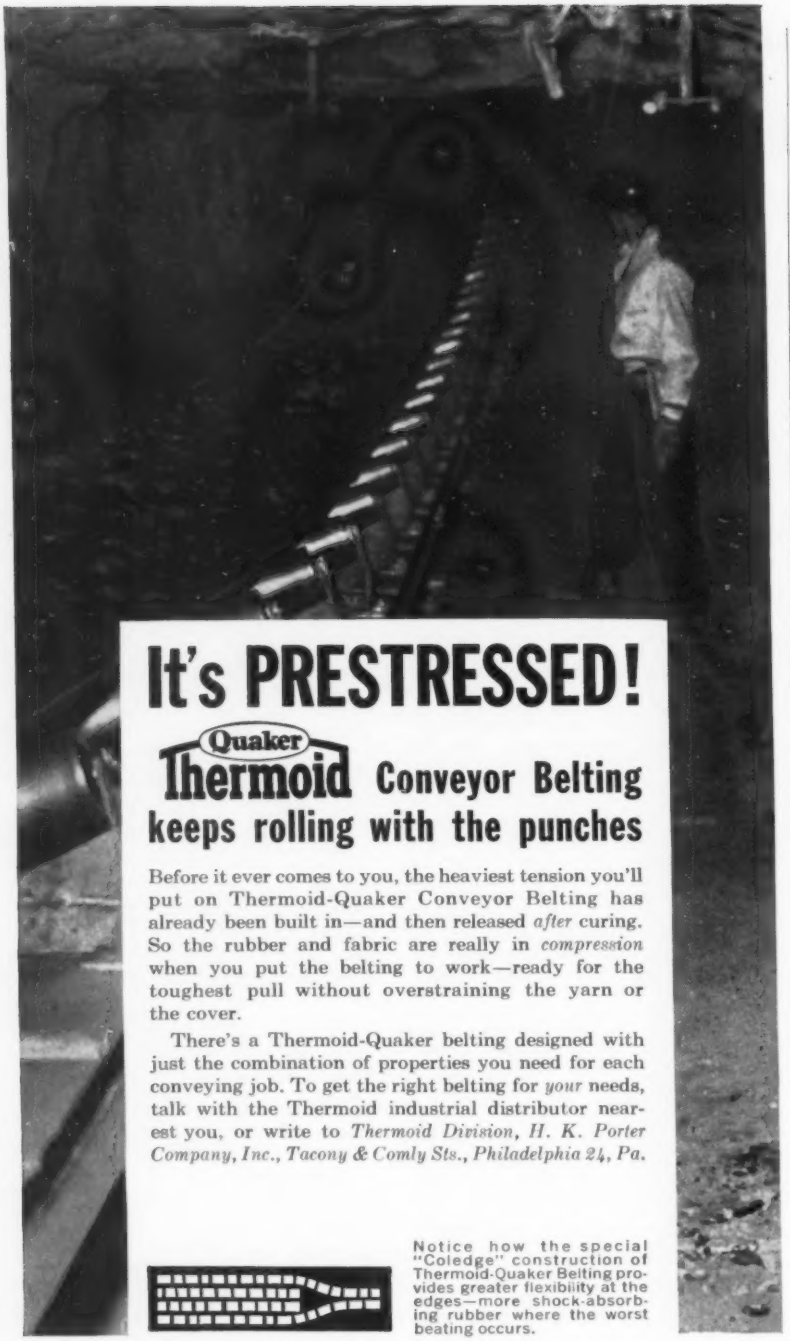
A rare earth ore body with minerals in coarse grained magnetite and pegmatite has been discovered while mining iron ore at the **Scrub Oaks** mine in Morris County, New Jersey. Minerals include xenotime, doverite, and bastnaesite. The United States Geological Survey's Bulletin 1082-B describes the deposit. Send $0.50 to the Superintendent of Documents for a copy.

New Jersey Zinc Company is steadily increasing its zinc ore mining rate at the company's new Friedensville, Pennsylvania zinc mine. It is planned to bring the mine up to capacity, 2,500 daily tons by the end of the year. Zinc concentrate is smelted at the company's Palmerton smelter. Sterling Huyett is superintendent.

United States Steel Corporation has perfected a new process for reducing very fine iron ore to iron using fluid bed reactors and a reducing gas. The process is termed "Nu-Iron" and was developed at the South Works. Minus-1/16-inch ore is contacted with hydrogen or carbon monoxide at high temperatures in the new process. A semi-commercial plant will probably be built.

Reynolds International Inc., overseas manufacturing and sales arm of the **Reynolds Metals Company** at Richmond, Virginia, has been set up as a separate unit with independent management in recognition of the growing importance of the firm's stake in world markets. J. Louis Reynolds has resigned his position as executive vice president of Reynolds Metals to become chairman and chief executive of the International firm. Reynolds recently acquired 47 percent interest in **The British Aluminum Company Ltd.**

The **Tungsten Institute** has moved from Washington, D.C. to New York City. The new address is 500 Fifth Avenue. Officers of the organization remain the same.



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Before it ever comes to you, the heaviest tension you'll put on Thermoid-Quaker Conveyor Belting has already been built in—and then released *after* curing. So the rubber and fabric are really in *compression* when you put the belting to work—ready for the toughest pull without overstraining the yarn or the cover.

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CENTRAL AND EASTERN — IRON RANGES

The **M. A. Hanna Company's** new Homer-Wauseca shaft near Iron River, Michigan, which will handle iron ore from two of the firm's underground properties, has gone into production. The **Walsh Construction Company** of New York did the work on the 2,740-foot shaft and headframe, while the **Proksch Construction Company** of Iron River erected the main building. Also included in the project was construction of conveyor galleries which lead to the loading pocket and beyond to the stockpile loading unit. They will be used for truck stockpiling in the winter months.

A cargo of 800 tons of "spherical" ferrosilicon for use in various Mesabi Iron Range heavy media plants was the first shipment to come through the new St. Lawrence Seaway to the port of Duluth. In 1958 this product won one of the MINING WORLD Blue Ribbon Equipment Awards. (See page 67, MINING WORLD Catalog, Survey, and Directory Number, 1958, for a description of the product.)

Iron ore shipments to June 1 had already amounted to nearly 16,000,000 gross tons this season in the Lake Superior district. Last year at the same time, only 4,000,000 tons had been shipped. Operations (through June 30) on the Mesabi Range are at nearly 100 percent capacity, with taconite plants operating at full capacity.

The western extension of the **Huntington** open pit iron mine of **M. A. Hanna Company** reportedly will be shipping before the end of this season. This property is just west of Crosby, Minnesota where the company also operates the **Feigh** and **South Hillcrest** open-pit properties. This area is now almost one big open pit.

A bill to permit taconite mining companies in northern Wisconsin to obtain a large water supply from lakes and streams was passed by the state Assembly and sent to the Senate. The Assembly vote was 93 to 0. The approved bill was a compromise worked out after the original bill and a substitute both ran into opposition. It establishes the right of taconite mining firms to obtain water withdrawal permits under State Public Service Commission regulations, and avoids setting a time limit on the withdrawal permits, as earlier versions had done. The final approved version would allow the withdrawal of water "for such time as is necessary to permit the mining to exhaustion and processing of all iron ore referred to in the application (to the Public Service Commission)." However, the commission could review the permits from time to time to protect the public interest.

The **M. A. Hanna Company's** new Groveland jaspellite plant near Randville, Michigan has gone into operation and had reached designed capacity rate at the end of the first week. The plant is located at the **Groveland** mine, an open-pit operation containing an estimated 100,000,000 tons of ore. The first ore shipment of 65 percent iron concentrate went to the **Granite City Steel Company** in Illinois.

NORTHWEST

Construction of a $2,000,000 clay and silica refining plant at Bovill, Latah County, Idaho, has been started by the **J. R. Simplot Company** of Boise. The refinery will process kaolin-type clay which will be mined by open pit methods. Stripping of overburden is underway. Production is scheduled to begin late next fall. Plans call for mining more than 200,000 tons of raw clay yearly and processing and shipping about 100,000 tons of processed clay and an equal amount of silica. A rock crushing plant has been installed to provide construction aggregate. An office building and laboratory also have been completed and the **Washington Water Power Company** is laying a 34-mile natural gas pipe line from Moscow. W. Grant Kilbourne is vice president and general manager of Simplot's minerals and chemical division.

Agency Creek Thorium and Rare Metals Corporation is shipping 400 tons of thorite from its Agency Creek property near Salmon, Lemhi County, Idaho, to **Batershell and Greenwood Company** at Denver, Colorado. The Salmon firm also is considering mill construction.

Sunshine Mining Company has decided to sink a shaft 300 feet below the bottom 4,000-foot level of the **Sunshine** mine in the silver belt of the Coeur d'Alene mining region, Shoshone County, Idaho. The location will be in the eastern part of the mine where a half dozen drill holes have probed the downward extension of an unknown vein found in the foot-wall of the Chester fault. New 4,150 and 4,300 levels will be opened. The 4,000-foot level is about 1,000 feet below sea level, the deepest horizon yet reached in the district.

Sidney Mining Company, whose zinc-lead mine in the Pine Creek district of the Coeur d'Alene mining region, Shoshone County, Idaho is about worked out, has three new projects going in Idaho. Production at the nearby **Nabob** mine was started in April and was expected to reach 3,000 tons in August or September. Deepening of the Nabob shaft is under way. Values are in lead zinc, and silver. Development work is under way at the firm's uranium properties on Basin Creek near Stanley, Custer County, and joint exploration is being carried out in the old Bayhorse district. M. C. Brown, Kellogg, is president.

At the **Conjecture** silver-lead mine in the Lakeview mining district of Bonner County, Idaho, **Federal Uranium Corporation** of Salt Lake City, Utah is doing exploration and development work from the 700 and 1,000-foot levels of a newly completed three-compartment vertical shaft. About 2,000 feet of drifting is planned from the bottom 1,000 level to get beneath the old shaft workings and to open virgin ground. Walls of the main Conjecture vein will be diamond drilled to locate another vein discovered in cutting an ore skip pocket in the sump below the 1,000-foot level. Federal Uranium has spent more than $900,000 at the property under a profit-sharing agreement with **Conjecture Mines, Inc.**, headed by Donald E. Majer of Spokane.

Closing of the **Blackbird** mine at Cobalt, Lemhi County, Idaho, the nation's only cobalt mine, was scheduled for the first week in June when federal officials could not make up their minds on whether to extend the current purchase contract. The government contracted to buy colbalt from the operating **Calera Mining Company,** a subsidiary of the **Howe Sound Company,** at $2.30 a pound but imports have driven the domestic price down to $1.75 a pound.

Idaho Goldfields, Inc. is operating a small concentrator at its lead-zinc-silver property near the summit of Fourth of July Canyon, east of Coeur d'Alene, Kootenai County, Idaho, and making truck shipments of concentrates to the **Bunker Hill Company** smelter at Kellogg. L. A. Thompson, Spokane, company president, directs the work.

Lucky Friday Silver-Lead Mines Company is making good progress in building a 400-ton concentrator scheduled to be put into operation early in 1960. Mine production at the Shoshone County property is at a record 280 tons daily. **Hecla Mining Company** controls and operates the mine.

Idaho Mining and Milling, Inc., Lewiston, Idaho, has started the first phase of its project to dismantle, move, and rebuild a No. 2 connected bucket-line Yuba dredge from Warren, Idaho to its gold placers in the Florence Basin. Company president is Philip W. Jungert.

Leasing of upper workings of the long-idle **Bear Top** mine near Murray, Shoshone County, Idaho, is being considered by **Merger Mines Corporation.** C. H. Hunter of Hayden Lake is president.

Although losing a little money at the present price of lead, **Clayton Silver Mines** is continuing mining operations in Custer County, Idaho in hope Congress will legislate some new aid to lead-zinc prices. Pumping costs would be between $5,000 and $7,000 monthly in case of a shutdown. Necessary development work also is being done.

Lookout Mountain Mining and Milling Company of Kellogg, Idaho is resuming work at a copper-gold-silver prospect in the Murray area of northern Shoshone County, acquired last year. Additional diamond drilling and bulldozing are planned. A small gravity concentrator may be installed for a test run of ore from surface outcroppings.

Two hundred sixty-five miners at the **Page** lead-zinc mine west of Kellogg, Shoshone County, Idaho, returned to a four-day work week recently because of low base metal prices. The **American Smelting and Refining Company** operation was on a four-day week most of last year but went to five days last October.

A 200-foot, two-compartment shaft is being sunk at the property of **Nancy Lee Mines, Inc.** near Superior, Mineral County, Montana. About 125 feet of crosscutting from the bottom of the shaft also is planned to reach silver-gold-copper-lead-zinc ore outlined by down-hole diamond drilling. Work is being pushed on a six-day week basis.

The **Chemical Copper Company** has temporarily suspended copper mining and leaching operations in the old Copper City district six miles north of Three Forks. Oxidized ore was mined, leached, and the copper precipitated to produce cement copper for shipment to the smelter.

The **Anaconda Company** has resumed open pit operations at its Alice mine after the company and the city of Walkerville reached a mutually beneficial agreement. At Anaconda's request an emergency resolution was approved closing certain roads, streets, and alleys necessary for pit operation. At the city's request Anaconda will level a playground in North Walkerville and make other concessions.

The **Anaconda Aluminum Company** has granted an average hourly wage increase of 8.23 cents to its 400 employees at Columbia Falls, Montana. The increase was part of a new contract, which expires October 31, 1960, with the Aluminum Workers International Union.

The **Young-Montana Corporation** is making regular shipments of high grade iron ore from its leased Willow Creek mine in the Running Wolf district south of Stanford. Initial shipments under a 75,000 ton contract were made in May as soon as snow conditions permitted. First shipments of ore, Bessemer type lump averaging 60 percent iron, were made by the firm in 1956. Shipments were expanded in 1957 to 26,228 tons, and curtailed in 1958. The company's president, E. A. Young, has been an important independent iron ore miner on the Mesabi Range, Minnesota for many years.

For the first time, ten $500 scholarships are being awarded to freshmen entering the **Montana School of Mines.** The scholarships for the academic year 1959-1960 will go to students of high scholastic attainment who intend to major in one of the fields of the mineral industries. Interested students should apply to Professor W. M. Brown, chairman of the Scholarship Committee, at the school in Butte.

Lakeview Mining Company is now milling open pit uranium ore at its Lakeview, Oregon mine. Open pitting was contracted to the **Isbell Construction Company** of Reno, Nevada after heavy ground increased cost and slowed underground mining. Ore now being milled was fairly close to the surface and was quickly mined in the pit and stockpiled for the mill. Waste stripping continues for deeper ore. A second pit may be developed in the future. James Poulos is general manager.

A $500,000 expansion program is underway at the **National Metallurgical Company's** silicon operations at Springfield, Oregon. Plant capacity will be

SAUERMAN NEWS briefs

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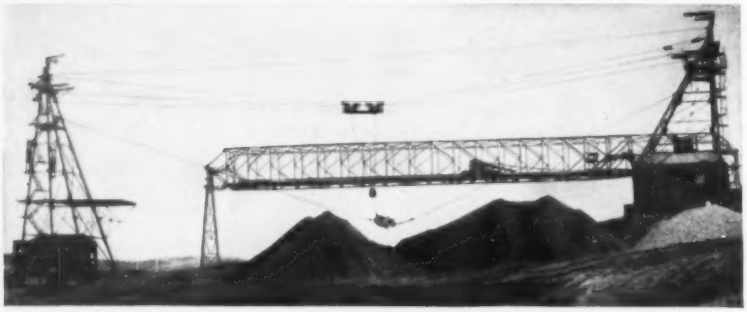


Cableway-DragScraper Blends, Reclaims Stockpiled Ore

Over a million tons of iron ore may be stockpiled in the new facilities of a South American mining company. The DragScraper permits better blending of the ore and reclaims all stockpiled material that does not flow by gravity into two 3000-ftph. tunnel conveyors.

The 10-yd. Dragscraper is suspended from a carriage traveling on a track cable between two self-supporting towers. These travel on tracks paralleling the storage area. Despite the size of the Sauerman installation, it may be controlled by one man.

(Condensed from a forthcoming Sauerman News)

Efficient Slag Removal

A 4-yd. Sauerman DragScraper machine is incorporated in the waste slag disposal system of a large copper smelting operation. The slag is flumed into two dewatering tanks separated by a common wall. After a tank is drained, the slag is reclaimed by the DragScraper to a hopper at the head end. The DragScraper is remotely operated from a station above the hoist to provide good visual coverage of the installation.

The monorail-trolley assembly at the tail end provides lateral movement of the DragScraper. The monorail spans the tanks, and a Durolite single block on the trolley carries the backhaul cable. Shifting is handled by a motorized winch remotely controlled by the hoist operator.

The DragScraper reclaims to the hopper at about 250 tph. The hopper, in turn, feeds a conveyor belt which carries slag to the disposal area.

(Condensed from Sauerman News No. 155)

Handling Phosphate Ore

Ore concentrate is stockpiled and reclaimed as required to the foot of a bucket elevator by a Sauerman DragScraper Machine at a Southern chemical plant.

A self-propelled tail tower travels around the perimeter of the stockpile. The tower is shifted to change the line of operation. DragScraper haul length is 400 ft. The operator's station for the Sauerman hoist is located above the conveyors to give a clear view of the pile.

(Condensed from Sauerman News No. 151)

MORE NEWS AND INFORMATION

Issues of Sauerman News giving greater detail about the installations on this page are available on request. For more information on your materials handling requirements, contact Sauerman Bros., Inc., 638 S. 28th Ave., Bellwood, Ill. Linden 4-4892.

NORTHWEST

doubled by July when a new 3,000-kw electric furnace is expected to be in operation. The silica for the plant comes from deposits near Reno, Nevada and Rogue River, Oregon.

WASHINGTON

Pend Oreille Mines and Metals Company has made plans to boost production at its Metaline district holdings (Pend Oreille County, Washington) to 10,000 tons a day or 3,000,000 tons a year when the lead-zinc marketing situation permits. Present capacity is about 1,000,000 tons a year. A total of 607,695 tons of zinc-lead ore was milled in 1958. Jens Jensen, Spokane, is president.

Dawn Mining Company's uranium processing plant at Ford, Stevens County, Washington, is accepting amenable ores averaging 0.16 percent uranium oxide for the remainder of this year. The minimum acceptable grade had been 0.20 percent uranium oxide. Shipments are being accepted in lots as low as 300 dry tons, compared to 350 tons a year ago and 500 tons when the plant started operation in 1957. J. J. Crowhurst is manager.

At the **Gladstone** mine near Leadpoint, Stevens County, Washington lessee A. G. Lotze is planning to sink an additional 100 feet in search of new chimneys of high-grade lead ore. Since last fall he has deepened the two-compartment shafts 51 feet and done 110 feet of drifting and 60 feet of raising in ore assaying about 17 percent lead. He is considering installation of an upgrading mill. He has put in a new blower, 200 feet of 11-inch ventilation pipe, 350 feet of 8-inch ventilation pipe and a new 120-horsepower International gasoline motor.

Aerial and ground magnetometer surveys of the Republic-Danville area in northern Ferry County, Washington have been contracted by the Washington State Department of Conservation to determine whether magnetic iron ore is present in quantities that would justify a Washington steel industry. The legislature set aside $140,000 for surveys of iron, limestone, clay, and coal resources, of which $60,000 was ticketed for the Republic-Danville iron surveys.

The **Bureau of Land Management** has examined 35 percent of the 13,000 mining claims located in the Colville Indian Reservation of Washington between 1898 and 1934 before it was closed to mineral entry. BLM engineers have been having considerable difficulty in locating claim boundaries because corner posts have rotted away. The project was started in July of last year under a 1956 law restoring to the Colville tribes ownership of undisposed-of or surplus reservation lands held in trust by the United States.

Two new mining operations are under way at the Mount Spokane district property of **Daybreak Uranium, Inc.** in northern Spokane County, Washington following a winter shutdown. A new tunnel is being driven from the original open-pit workings and a new open-pit mining operation is being conducted about 600 feet to the east.

SOUTHWEST

Duval Drills Ithica Peak In New Search for Copper

Duval Sulphur and Potash Company is seeking to develop its second Arizona porphyry copper deposit. An exploration program of geological mapping and churn drilling is underway at Ithica Peak at Mineral Park near Chloride, Mohave County, Arizona.

Duval recently placed in operation a 12,000-daily-ton, copper-molybdenum, open-pit mine and flotation mill at the Esperanza mine south of Tucson. The same geological staff that developed the Esperanza ore body is in charge of the Ithica Peak project under the direction of Harrison A. Schmidt, consulting geologist, and B. G. Messer, assistant resident manager of Duval's copper division. Everett Smith, engineer, is in charge of drilling.

Ithica Peak is a quartz monzonite stock mineralized with pyrite and chalcopyrite. Several shear zones showing extensive copper mineralization cut the stock. In the early 1950's Kennecott Copper Corporation optioned a large number of claims in the district and drilled five surface diamond drill holes. All were reported to contain copper with some assays between 0.3 and 0.6 percent. Kennecott soon abandoned its work and the district has been very quiet until Duval's interest.

In view of the large size of the stock and the extent of known mineralization, many engineers and geologists felt that Kennecott's work had not eliminated all favorable areas; thus, the Duval program of drilling. Some of the work in areas close to Kennecott's holes is being watched with interest.

More than 200 claims have been optioned or staked by Duval. Claim options were obtained from Lyon Kay, John Gates, John Gross, C. L. Lind, Fred Babcock, the Wallace family, and several other miners.

An open-pit operation has been started at the **Burro** claim of **Coronado Copper and Zinc Company** by Strong and Harris, Inc., lessees. The Burro claim is near the **Republic** and **Moore** mines at Johnson Camp, Cochise County, Arizona, and carries a high silica copper ore. Four men are employed, working six days per week, with total production running between 10 and 15 carloads per week. The ore is trucked to Dragoon for shipment by rail to the **Phelps Dodge Corporation** smelter at Douglas for use as flux. Ira L. Mosely of Lordsburg, New Mexico, is manager.

An underground diamond drilling program is to be started shortly at the old **Senator** mine near Prescott, Arizona, by **Aricana Resources Corporation**, controlled by **Abbican Mines, Ltd.** Plans call for about 5,000 feet of diamond drilling, according to the recommendations of R. F. Muliette, the company's consulting engineer. A 200-ton mill, privately financed, is already partially constructed. George D. Harvey of Prescott, is superintendent.

The **Paramount Mining Company** of Tucson, Arizona, has leased the **Highland** mine (Mame shaft) located in the Turquoise District of Cochise County. The new operators propose to leach the ore in place, both from the surface and underground. The Mame shaft is said to be 350 feet deep, with a considerable amount of old workings on the 100, 200 and 300 levels, and with water extending to within 155 feet of the shaft collar. The upper portion of the shaft has been repaired and shaft pumps installed, the work being directed by William Ward of Tombstone. The Highland mine is owned by the **Hope Mining and Milling Company** with L. C. Mead as president.

Metate Asbestos Corporation has opened its new $150,000 asbestos processing plant near Globe, Arizona. The firm expects to turn out 30 tons of finished fiber a week on a two-shift basis. About 12,000 tons were stockpiled before operations began, and the firm expected to reprocess this at a rate of about 25 tons per day. General manager is Jack Neal.

The **Oro Fino Mines, Inc.** of Prescott, Arizona is maintaining a regular produc schedule at its **Silver Crown** mine in the Walnut Grove district of Yavapai County. Two shifts are worked in the mine, and one at the mill. The shaft has been sunk an additional 60 feet this year and a new level opened at 263 feet below the surface, or 190 feet below the operating adit level. A drift was driven 115 feet southwest on the vein from the bottom of the shaft and stoping is in progress there as well as on the 203-foot level. A new loading ramp was built at Kirkland, cutting the trucking distance from 30 to 10 miles, and several carloads of concentrates have been shipped. L. W. Rayer is executive vice-president in charge of operations, Sam Caster is mine superintendent, and Ralph Fairchild, mill superintendent. Principal ore values are in lead, followed by silver, gold, and copper.

Production of uranium ore was begun recently on Tract 17 in the Navajo Indian Reservation of Arizona. **Sidney Mining Company** of Kellogg, Idaho, has a 60 percent interest in the joint venture with **Mascot Mines** and Inar Norgaard, also of Kellogg. The firms recently completed extraction of an ore body on Tract 11.

Reports indicate that the **Sunrise Mining Company** is producing an average of 20 tons of lead ore daily, or 450 tons monthly, at its **Glove** mine in the Tyndall district of Santa Cruz County, Arizona. In addition to ore production, a raise is being put through to the surface. Plans call for the raise to be enlarged and timbered to shaft dimensions (about 7 to 9 feet), thereby providing a vertical hoisting shaft from the surface to the 360-foot level. At present the ore cars are hand-trammed from 200 to 300 feet on the 360-foot level, hoisted up the winze to the 240-foot level, hand-trammed about 400 feet, dumped into the ore skip and hoisted up the inclined shaft to the ore pocket above the adit level. From there the ore is drawn into ore cars and hand-trammed another 600 feet to the surface ore bin. G. W. Irvin of Sahuarita, Arizona, is general manager of mining operations. Alfred M. Durazo is mine superintendent.

Floyd Brown of Wenden, Arizona, is in charge of milling operations for **World Minerals Corporation** at its mill (the old Sitton mill) in the Artillery Peak area. The ore supply comes from Brown's leasing operations at the **American** and **Black Jack** mines. M. S. Clark of World Minerals Corporation expects to mine and ship ore to the mill from the near-by **Indian** mine.

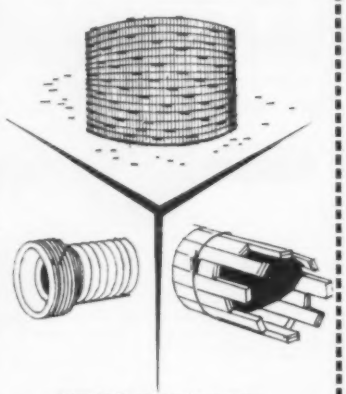
The production of **Sonoma Quicksilver Mines Inc.** is steadily increasing as extensive underground improvement work is beginning to be reflected in mining operations. The improvement program is to be completed by the end of August. The mine is located in Sonoma County, California, and has been operated intermittently since 1874. The firm's ore values over the 10 months ended April 30, 1959 averaged somewhat higher than the national average. The company produced 3,448 flasks (76 pounds each) of mercury from 26,375 tons of ore furnaced, with average recovery being 9.93 pounds of mercury per ton of ore. When in full production after the improvement program is finished, the furnace will increase its maximum capacity from 90 tons a day to 110 tons.

Kern County Land Company of San Francisco, California spent $220,000 in hard materials exploration during 1958 and plans to invest the same amount this year. The Hard Minerals Department concentrates mainly on sources of industrial minerals.

International Minerals & Chemical Corporation has sold its perlite plaster aggregate plant in Los Angeles, California to **Redco Inc.** The firm's industrial minerals division now intends to concentrate on expansion of its perlite ore business. IMC mines and markets perlite in the Los Angeles area and had manufactured perlite aggregate there for about five years.

A report to **Carrigan Mines Inc.** of San Leandro, California by Francis H. Frederick, mining geologist, indicates that there is sufficient autunite on the Carrigan property to merit further drilling. The property is located in Tuolumne County, California. On work done to date, Mr. Frederick reports that the best ore layer is at elevation 7,010 and is probably the same ore and sedimentary horizon in which an open cut at elevation 6,990 exposed ore. He recommends driving of a 600-foot adit to further explore the area. The **Judd** property to the east has exposed ore in open cuts and drill holes in the same formation, and the **Volks** property five miles east has produced a substantial tonnage. The latter is being developed by **Lakeview Mining Company** of Lakeview, Oregon.

Kennecott Copper Corporation's Nevada Mines Division has placed its new $1,500,000 skip haulage system in operation in the Liberty Pit at Ruth, Nevada. By eliminating rail haulage up the mile-long track from the 700-foot-deep pit,



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the company expects to cut costs considerably. The skip track is 1,360-feet long, inclined at about 19°; vertical lift will be 435 feet. Design capacity is 1,000 tons an hour, and the company plans to operate on a three-shift system, moving about 21,000 tons of ore to the crest in each 24 hours.

Dodge Construction Company is now shipping about 15,000 tons of iron ore per month to Japan on an eight-month contract. A total of 130,000 tons is to be shipped from the property which is 30 miles east of Lovelock, Nevada. The ore will be trucked to Colada railroad siding on the **Southern Pacific** for shipment to the Port of Stockton, California where it will be loaded aboard cargo vessels headed for Japan.

Eagle-Picher Company is experimenting with alternate runs at its diatomite plant near Lovelock, Nevada. Under the plan, the plant operates on 24-hour shifts for a week, and then shuts down for a week. One advantage is that only one firing of the rotary kiln is necessary. The firm will make cost comparisons in order to evaluate the procedure.

A geological, geophysical, and economic study may be made this summer of the **Golden Bar** and **Golden Arrow** gold mines in Nye County, Nevada. The property is held by John T. H. Whitaker and associates. Mr. Whitaker, Morris Showalter, and Garvin W. Hale have formed **John St. Luff Mining Associates** to lease and purchase mining properties in the West, and this will be one of their first ventures. No mining program on the Nye County property will be undertaken until the planned surveys prove the existence of sufficient ore to merit development work.

Big Divide Mining Corporation is driving an adit into the southwest slope of Gold Mountain near Tonopah, Nevada in an attempt to find at depth the gold ore found on the surface in years past. Work is continuing on a two-shift basis, and will include reopening of the Tonopah Divide shaft at an early date. The 265 and 370 levels will be prospected first, and the 500 and 800 levels later. The property consists of 21 patented lode claims leased from **Tonopah Divide Mining Corporation.**

Roy Hardy reportedly is seeking to interest Canadian financial circles in reopening the old **Atlanta** gold mine, located 50 miles north of Pioche, Nevada. Under consideration is the moving of the **Golden Crown** cyanide plant to the mine site, which it is estimated would cost about $250,000 to do.

American Colloid Company is seeking patents on several bentonite claims in the Coal Canyon district of Nevada. One claim covers 80 acres and the other, 120 acres; both are in T. 27, R. 33.

Alaska International Corporation of New York City is reported to have leased cinnabar and manganese properties in Humboldt and Pershing counties, Nevada. The **Victory** manganese claims, owned by Homer Winters and recently worked by **Western Mining Corporation** were leased by Alaska International, along with properties of Walter Polkinghorne, Virgil Olson, W. Earle Simpson, Sr. and Jr. The latter consist of a cinnabar property near Unionville and a manganese property in Pollard Canyon, 35 miles south of Winnemucca.

Kollsman Minerals and Chemical Corporation is steadily producing quicksilver from its **B & B** mine in Fishlake Calley, Esmeralda County, Nevada. An ore dryer was recently installed in the mill.

NEW MEXICO

Under a cooperative agreement with **Entrada Corporation, Boyles Brothers Drilling Company** is currently sinking a new shaft in the northwest quarter of Sec. 11, T. 14 N., R. 10 W. in the Ambrosia Lake district of New Mexico. The mine is the **Mary No. 1** with estimated reserves of 1,680,000 tons. **Phillips Petroleum Company** has agreed to buy the ore for its mill.

General Mining and Milling Corporation has subleased a large iron ore deposit located south of Scholle, New Mexico from **Dotson Minerals Corporation** and R. L. York. Reserves of 3,000,000 tons of high grade ore are claimed to exist, and the company hopes to have production under way shortly at a rate of several hundred tons per day.

Starting in September, uranium concentrates from the Grants, New Mexico area will be shipped directly to the AEC plant at Weldon Spring, Missouri instead of to the Grand Junction, Colorado sampling plant. The latter will then serve only the scattered producers on the Colorado Plateau. This will save New Mexico producers considerable haulage and freight expense.

Phillips Petroleum Company has awarded a contract for shaft sinking on its property in the Church Rock area of New Mexico which it is developing jointly with the Quinta Corporation. Since the ore body occurs below the water table, it is expected that the shaft and mine development will be wet, and Phillips' engineers are preparing for this condition. The shaft is to be about 1,000 feet deep. This property is about 65 miles from the firm's uranium processing plant in the Ambrosia Lake district. It opened last year with a designed capacity of 1,725 tons per day but has been refining 2,200 tons a day.

TEXAS

American Zinc Company of Illinois is completing an extensive mechanization program at its zinc retort smelter in Dumas, Texas.

A $3,000,000 plant for the production of high grade magnesite (periclase) will be built by **E. J. Lavino & Company** at Freeport, Texas. **Dow Chemical Company** will supply magnesium hydroxide from its regular output from its Freeport plant. The Lavino plant is to be built on land purchased from Dow adjacent to Dow's plant which will permit delivery of the hydroxide by pipeline.

precipitates—ROCKY MOUNTAIN

Plan Major Chemical Plants At Sulphurdale, Utah

A major open pit sulphur mine, sulphuric acid plant, and hydrofluoric acid plant are planned at Sulphurdale, Beaver County, Utah by Dixon-Western Chemicals, Inc.

Dixon-Western is an associate of American Sulphur & Refining Company of Beverly Hills, California which formerly operated the sulphur mine and a solvent extraction sulphur plant at Sulphurdale. While the solvent process was a technical success it proved uneconomic at that location so the decision was made to build a new contact acid plant with a FluoSolids reactor. Sulphuric acid will be sold to industrial users and eventually used in the proposed hydrofluoric acid plant.

Dixon Chemical and Research, Inc. of Bloomfield, New Jersey is associated with American Sulphur in the new project.

American Sulphur controls extensive reserves of fluorspar which would be mined for use together with sulphuric acid in the hydrofluoric acid plant. William N. Neale is vice president of Dixon-Western with headquarters in Beverly Hills.

Bear Creek Finds Ag-Pb-Zn At Eureka, Utah Shaft

Three lead-zinc-silver discoveries have been made by Bear Creek Mining Company at its Burgin mine near Eureka, Utah. Other geologically favorable areas will be prospected in the future. Bear Creek is Kennecott Copper Corporation's exploration subsidiary.

A diamond drill core from a 1,000 foot deep surface hole assayed 20 ounces silver and 20 percent combined lead and zinc per ton. Underground drifting on the 1,050 foot Burgin level has developed complex sulphide ore in two areas. One drift is being driven in silver-lead ore. Another drift cut three feet of high grade lead ore with some zinc and silver. Diamond drilling below the level has disclosed good values with 80 feet of core from one hole averaging 20 ounces silver, 20 percent lead, and 20 percent zinc per ton. To date mineralization has been outlined for 1,400 feet east and west and 600 feet north and south. Ore is found in limestone and dolomite so that much development work is necessary to actually block out the very irregular ore bodies.

Bear Creek is the operating partner for a large group of claims owned by Chief Consolidated Mining Company, Tintic Standard Mining Company, Eureka Lilly Consolidated Mining Company, South Standard Mining Company, and Eureka Standard Consolidated Mining Company. Bear Creek's exploration program is based on results of extensive geochemical and geological studies of the area. Extensive mining and large scale production has been made by adjoining mines.

Average 1958 U_3O_8 Price $9.36 per pound in U.S.

Uranium concentrate produced by 23 western mills in 1958 was valued at $233,045,449 according to the United States Atomic Energy Commission. This was a major increase from $166,909,013 value of 1957 output from only 16 mills. It is estimated that 1959 output will be valued at close to $250,000,000.

Uranium, the infant of the mining industry, grew in a few short years to be the third most valuable United States metal in terms of domestic production. Iron ore led at $675,000,000; copper was second at $538,000,000; while zinc showed $80,000,000, lead $64,000,000, and gold only $61,000,000. Sulphur, the most valuable non-metallic mineral, was valued at $100,000,000, and fluorspar and bauxite $15,000,000 each. Metallic aluminum, most of it produced from imported ores, was valued at $800,000,000.

Utah uranium miners received the largest sum, $67,472,991 but received the lowest average price per pound—$8.65. The highest pound price went to Arizona, Washington, South Dakota, and Wyoming miners—$10.26. Colorado miners received $10.08 a pound, and New Mexico miners $9.10.

The 23 mills operating in 1958 cost $134,928,000 but they couldn't keep pace with ore discoveries which placed unmined reserves at an all-time peak of 82,500,000 tons.

Denver-Golden Oil & Uranium Company is currently building a two-mile access road to the firm's gold mining operations in the Ice Lake region of San Juan County, Colorado. Also planned for this season is driving of a 1,200-foot adit to cut a series of gold-quartz veins prospected at surface last year.

The AEC office at Grand Junction, Colorado is notifying uranium mine operators that data on uranium ore reserves developed as of November 24, 1958 must be submitted to the Commission before August 1, 1959 by those who wish to be considered in negotiations for uranium concentrate procurement in the 1962 to 1966 period. The information should be submitted no later than July 31 to the nearest AEC office. These branches are at Denver, Salt Lake City, Grants, New Mexico, and Casper, Wyoming.

Richardson Mines is reopening the **Brooklyn** gold mine in San Juan County, Colorado. A new road was built last fall to the mine so ore can be trucked out instead of being packed on mules. Present plans are to mine the stope fills and ship to Leadville smelter of **ASARCO.** Development of the vein will also be started. Frank Richardson of Ouray, Colorado is company president.

Pinnacle Exploration, Inc., a subsidiary of **Callahan Mining Corporation,** is making steady shipments of uranium ore to the limit of present mill allotment. All ore is shipped to **Cotter Corporation** in Canon City, Colorado. The ore comes from an underground deposit at its **Indian Creek** property near Gunnison. The drilled out ore body was reached by an 850-foot adit. Philip D. Wilson of New York City is president.

Western Gold & Uranium Inc. is keeping its **Rito Seco** gold property near San Luis, Colorado in an inactive state as a hedge against a possible future increase in the price of gold. At the present price, the mine could make only a small profit per ton. Proven gold reserves are about 1,200,000 tons.

Joseph Stephan reports he has built a mineral separation table which, he claims, is capable of recovering 99 percent of the gold lost in present methods. He will try it out on a property north of Craig, Colorado which he has leased under the firm name of **Moffat County Mining Company.**

Under the new ore buying program set up by **Shenandoah Limited** to purchase custom ore from local shippers for its mill at Silverton, Colorado, lots as small as 50 tons, or less, will be accepted. The **Argyle Mining and Milling Corporation** is prepared to take the larger custom shippers. The Argyle firm is presently stoping at its **Pride** property. Both mills mean renewed activity in the district by small miners.

Ore reserves for **Climax Molybdenum Company,** division of **American Metal Climax, Inc.,** now total 472,000,000 tons or, before dilution in mining, equivalent to more than 2,000,000 pounds of molybdenum. The full extent of the ore body has not yet been defined. The mine produced and milled 6,363,000 tons of ore in 1958, only 60 percent of its record 1957 production. Lower output was caused by reduced sales. Byproducts recovered included 435,000 pounds of tungsten contained in concentrate, and minor amounts of tin and pyrite. In 1957 the mine had produced 744,000 pounds of tungsten. Although there was a lower rate of mine output, much of this was offset by higher recoveries from inital operation of the rebuilt and expanded byproducts plant completed early last year at a cost of $2,000,000.

Shasta Mining Corporation, a subsidiary of **Shasta Coal Corporation** of Chicago, will develop and operate properties of **Majestic Oil and Mining Company** in Beaver County, Utah. Shasta has already started drilling the **Old Hickory** mine, which Majestic holds under a lease, and plans to start operation of Majestic's flotation mill at Milford, Utah soon.

A $2,000,000 construction project has been launched by **Uranium Reduction Company** at its Moab, Utah mill for a new alkaline leach circuit replacing one of two existing acid leach circuits. **Western Knapp Engineering Corporation** of San Francisco has the contract for installation, scheduled for completion by January 1, 1960. The new circuit is expected to show a 50 percent cut in cost of sulphuric acid.

Delhi-Taylor Oil Corporation has been negotiating with two firms over possible development of its tremendous potash reserves at Cane Creek in Grand County, Utah. While it has not been officially revealed which firms these are, **Duval Sulphur and Potash Company** and **Texas Gulf Sulphur Company** have been rumored to be the companies involved.

Glen Larsen and associates, who have been operating the **Iron Blossom No. 1** and **No. 3** zinc-lead mines in Juab County, Utah under lease from **Tintic Standard Mining Company,** have applied to the Federal **Office of Minerals Ex-**

ploration for assistance in an exploration project. If approved, the funds would be used to extend the Larsen Winze from the 300-foot level to the 400-foot level where the ore in sight can be mined.

The **Spook** uranium mine of **Cog Minerals Corporation** in San Juan County, Utah has been leased to Clyde Fritz of Dove Creek and associates. The new operators expect to resume operations shortly and will ship to the Mexican Hat plant, as did Cog Minerals. A drilling program is also underway to locate additional ore reserves.

The over-all rate of production from the **Radon** and **Hot Rock** groups operated by **Hecla Mining Company** has been limited by the **Atomic Energy Commission** so the company has placed its mines on a five-day week instead of six. Production from the Radon uranium property near Moab, Utah in the first two months of 1959 totaled 10,734 tons assaying 0.64 percent U_3O_8, of which 25 percent or 2,684 tons are for the account of Hecla. Production from the Hot Rock claims which adjoin the Radon and are mined through Radon facilities, totaled 954 tons assaying 0.359 percent U_3O_8. Hecla will retain 100 percent of the Hot Rock production until total pre-production costs paid by Hecla are recovered, after which Hecla will receive 50 percent of the production.

Western Gold & Uranium Inc. is quite pleased with its **Alunite** property at the top of Mt. Edna in Utah and plans to continue metallurgical investigations during this year, as well as development of further ore reserves. The property appears to have considerable promise as a source for alumina, potash, and possibly other fertilizer products. The firm's **Silver Reef** property produced too much silver ore of only 8 ounce grade during last year, so that earnings were slightly below the break-even point. Also mill recovery was less than laboratory tests had indicated. The mine has been shutdown now until either a higher grade ore is found or there is an increase in the price of silver.

WYOMING

The **Atomic Energy Commission** has entered into ore buying and milling contracts with two more Wyoming firms. **Lucky Mc Uranium's** capacity of 833 tons per day, which was about double its original rating, was increased to 980. A new contract was signed with **Globe Mining Company** for a mill to be constructed in the east Gas Hills, in Natrona County, Wyoming. This mill will have a capacity of about 492 tons per day. Globe Mining is a wholly-owned subsidiary of **Union Carbide Corporation.** The mill is to be financed by Union Carbide and operated through a division, **Union Carbide Nuclear Company.**

A compromise on water rights was reached between **Columbia-Geneva Steel Division of U.S. Steel Corporation, Timba-bah Mining Company** and the **Little Popo Agie Irrigation District.** The steel company will exercise its option to buy water rights from Christina Lake, in the mountains above the proposed taconite mining project, near Lander, Wyoming, from Timba-bah. Timba-bah will, in turn, pay the irrigation district $6,500 for the water rights formerly in dispute. Columbia-Geneva officials said that the water would be used only in dry years. The steel firm will pay one-third of the cost of maintaining the Christina Lake Dam, and the irrigation district will pay the other two-thirds.

Columbia-Geneva Steel Division further strengthened its position in the Atlantic City, Wyoming area by buying 1,200 acres of placer claims from **Wyoming Mica and Metals, Inc.** of Lander, Wyoming. The steel company paid $20,000 for the claims, with Wyoming Mica and Metals retaining a 10 percent royalty of net smelter returns of any mica, precious metals, or fissionable materials, but not of iron. Columbia-Geneva officials said that it is not thought that iron to any considerable degree is on the property. It plans to build a reservoir on the property for its mining operations.

Western Nuclear Corporation of Jeffrey City, Wyoming negotiated a $6,000,000 loan to expand its mining and milling operations. President Robert W. Adams said that the expanded program would eventually mean employing over 300 workers. The company is currently undertaking one of the largest stripping operations in the history of the state, working on the removal of 20,000,000 cubic yards of overburden from the **Fraser LaMac** claims in the Gas Hills. **Maco Construction Company** has a $5,000,000 contract for the work.

The newly-formed **Gas Hills Partners** stockpiled its first uranium ore for its mill, which is scheduled to be completed by fall. The combine, formed as a mining and milling group, consists of three companies. **Federal-Radorock-Gas Hills.** Ray Lindlof is project manager, and Ed Buoy is mining superintendent. **Western Knapp Engineering** of San Francisco has the contract for the mill, which will be located in the Gas Hills area of Fremont County, Wyoming.

Antelope Mines, Inc. has sold its Gas Hills property to **Western Nuclear Corporation,** although retaining an interest. Antelope Mines will concentrate its work in the Shirley Basin uranium area, according to N. P. Juneman, manager. It also plans further development of beryl discoveries on Copper Mountain, in north Fremont County, Wyoming.

B & H Mines Inc. of Douglas Wyoming is now producing 100 tons per day of uranium ore from its open-pit operation. Dick T. Hornbuckle is vice president and geologist for the firm.

The **United States Geological Survey** has placed in open files a report on "Iron Deposits near Atlantic City and South Pass, Fremont County, Wyoming," by R. W. Bayley. The report may be inspected at the Office of the State Geologist, Geological Survey of Wyoming, University of Wyoming, Laramie, and Geological Survey Office, 213 Science Hall, University of Wisconsin, Madison, government facilities.

The **University of Wyoming** has purchased $40,000 worth of equipment for its uranium engineering program. The equipment will be used in both research and instructional fields of the school's nuclear engineering program.

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GETMAN BROTHERS

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Standard Uranium's Three Colorado Pb-Zn Mine Projects Underway; Start New Micawber Mill

Standard Uranium Corporation, one of Utah's largest uranium producers, is expanding into Colorado lead-zinc production on a large scale, at three mines. A new 125-ton-per-day, differential, lead-zinc flotation mill has gone into operation at the Micawber mine near Crested Butte. Two shifts are working to enlarge the portal of the American Tunnel at Gladstone, San Juan County, in preparation for slabbing the old tunnel and extending it under Sunnyside mine workings. A third project underway is development of the Letter G vein through the Mayflower mine at Silverton.

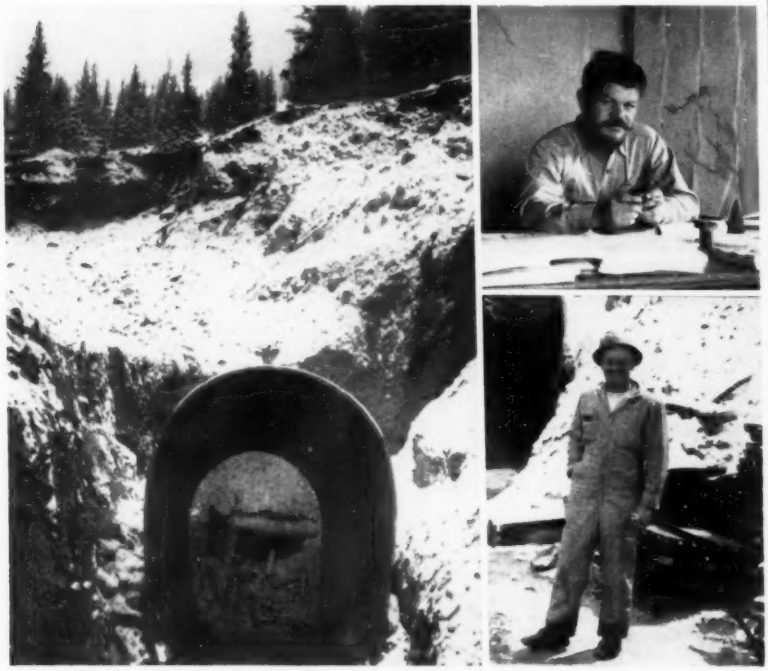
Standard has been developing the Micawber mine for two years and has proven lead zinc ore reserves in a vein two to 10 feet wide cutting sandstone. Jack Dressel is mine superintendent and Robert Ward is chief engineer.

Preliminary work is well advanced at the American Tunnel so that slabbing to a 9-by-10-foot cross-section can be started early in July. A completely new portal was established using Commercial Shearing's steel segments. These prefabricated sections are bolted together to form advancing rings. Creosoted, 12- by 12-inch timbers are used as sill plates for the steel. Muck is removed to the dump with a Michigan Model 85 A front end loader. One side and the back of the tunnel will be slabbed for a distance of 6,000 feet to the face. Then the full heading will be advanced about 4,800 feet to a point under the old workings of the Sunnyside mine. Raising into these workings will then be done. The Sunnyside was developed through adits and winzes from workings on the opposite side of the mountain from the American Tunnel portal.

About 1,800,000 tons of complex sulphide ore has been mined from veins up to 50 feet wide at the Sunnyside. The grade averaged very close to 0.06 ounce gold, 2.6 ounces silver, 1.15 percent copper, 3.1 percent lead, 3.32 percent zinc per ton. Excellent opportunities exist to develop a large tonnage of similar grade ore through the new tunnel.

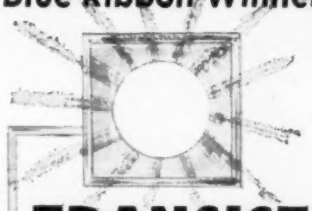
No expense will be spared in completely mechanizing tunnel operations with a 50-foot daily advance scheduled in the full heading. Identical equipment will be used for slabbing and driving and consists of a three-machine jumbo mounted on crawler tracks and powered by a 15-horsepower air motor. The jumbo mounts three Gardner Denver D-93 machines with 10-foot-long 1⅛-inch tungsten carbide detachable bits. An Eimco 630 mucking machine loads a new six-car slusher train designed by Shaft and Development Machine Company and built by Card Iron Works. The train holds one 10-foot heading round or an 18-foot slab round. The 36-inch track is being laid with 52-pound rail. Two, 685-cubic-foot, electric driven compressors furnish air. A 24-inch ventilation pipe will clear the heading so that two rounds per shift can be blasted.

Russell Wood of Moab, Utah is manager of all of Standard's mining and milling operations. W. R. McCormack of Moab is company president, and is taking a strong part in planning the Sunnyside development.



SEGMENTED STEEL TUNNEL LINERS are used at the portal of the American Tunnel in place of timber sets shown in background. Bob Hurst (top) is general superintendent of Standard's mining operations. Roy Pattie, tunnel foreman, stands at American portal.

A Blue Ribbon Winner



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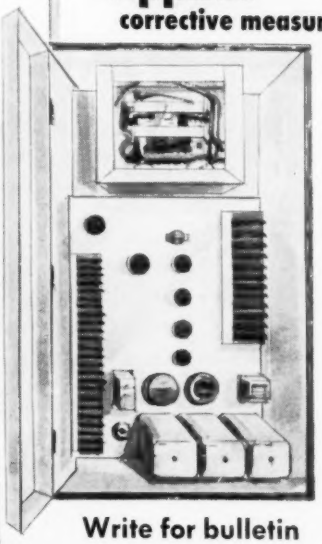
TROL

Senses position of materials . . .

- Controls equipment
- Signals equipment failure
- Applies corrective measures



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LATIN AMERICA

BRAZIL—The Brazilian steel firm of **Mannesmann** reports it will build the first aerial tramway for transportation of its iron ore near Belo Horizonte, state of Minas Gerais. In the same area, **Icominas** plans to export $20,000,000 to $25,000,000 worth of iron ore as it develops its **Itabirito Peak** deposits. In an agreement with **Central do Brasil Railway,** the firm will supply over $10,000,000 in rolling stock to facilitate shipment of its ores. An $8,000,000 investment is to be made in improving its mining facilities.

MEXICO—New equipment has been installed by **Magnet Cove Barium Corporation** in its production plant at Salinas, Coahuila. The equipment includes eight concentrating tables, a rod mill, and pumps—all part of a new processing system for recovering barite from tailing of the present jigging operation. Waste rock from the new recovery system will contain very little barite ore; it will be pumped to a tailing pond.

CHILE—**Andacollo Mining Company Ltd.** has acquired from the government 100 hectares in the Canelillo Valley, representing the northwest extension of the firm's Ceniza and Esperanza veins. The company has also negotiated an option with the owners of the **San Juan** copper mine, some 10 kilometers from Llayllay. Some dewatering and sampling of the mine is now underway.

VENEZUELA—**Western Oil Fields, Inc.** of Denver, Colorado and its partner, **Trans Western de Venezuela,** plan to start producing iron ore this summer from a 15,000-acre property in the Cerro Bolivar area.

CHILE — **Braden Copper Company's** new $1,700,000 acid plant at Catelones has gone into production and is now supplying sulphuric acid to the flotation plant at Sewell. At present 90 to 100 tons of acid are being produced daily. The equipment for the acid plant was purchased from the German firm of **Lurgi** under a special Chilean government decree which allowed the machinery to be brought in duty free. Lurgi's technicians supervised construction and final tests.

ARGENTINA — Development of the manganese and gold mines of **Farellon Negro** in the province of Catamarca will be developed under the direction of a national agency headed by Julio Millan, a mining engineer from the National University of Tucuman. The mines were explored by the National University and then placed under the jurisdiction of this new agency, composed of two representatives of the province of Catamarca, two representatives of the University, and a president named by the Central government.

CHILE—The Chilean government has announced plans for financing the **Tarapaca-Antofagasta Nitrate Company.** Special bonds will be issued to aid in the expansion of the Oficina Victoria, allowing for installation of new processes and machinery. The government's plan also call for investigation into market areas for nitrate which can be served by the local railways, such as Argentina, Uruguay, and Brazil. The government has also announced a plan for aiding small and medium-sized mines in Chile. A $10,000,000 fund is to be available for purchasing machinery and milling facilities. Long-terms funds will be available to mines which are approved by **Corporation de Fomento de la Mineria.**

MEXICO—**San Francisco Mines of Mexico Ltd.** has completed the remodeling of its mill and installation of a more powerful hoist in the past year. Ore reserves have been increased by nearly 10 percent by underground development work. In the fiscal year ended September 30, 1958, the firm incurred a loss of $580,000 and, for the first time in 18 years, declared no dividend. The heavy Mexican taxes on gross revenues had a particularly severe effect on net income, according to the company.

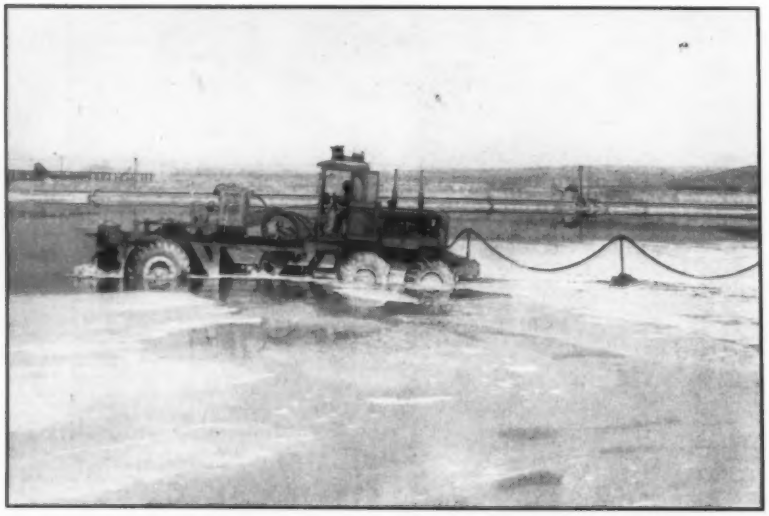
URUGUAY—The **U.S. Steel Corporation** is operating a transfer station in Uruguay which handles manganese ore mined in Brazil. The ore comes down the Paraguay and Panama Rivers to the receiving station in Uruguay for transshipment overseas.

MEXICO—**Minerales Pennsalt S.A.** is operating the largest open-pit fluorspar mine in Mexico, its **La Consentida** mine southeast of San Luis Potosi. Nearby is the large **Las Cuevas** mine of the **Noranda Company,** a subsidiary of Canada's **Noranda Mines Ltd.** Both mines export metallurgical fluorspar to the United States and have no mills.

PUERTO RICO—Deposits of pyrophyllite, alunite, kaolin, and quartz have been found on Cerro La Tiza Mountain 16 miles southwest of San Juan. The deposits are said to total 1,500,000,000 tons altogether. Discovery was made by F. A. Hildebrandt and R. J. Smith, geologists working for the **Economic Development Administration.**

CHILE—The ports of Caldera and Chanaral, which in 1957 were able to load only 1,500 to 2,000 tons daily for export, are now able to load at a rate of 1,500 tons per hour. Recent mechanization, plus improvements in the railways, now enables these ports to increase exports to about 105,000 tons monthly. A reduction in production and transportation costs has come with the port improvements. When deposits in the Atacama province go into production, Chile's iron ore shipments through these ports will increase even more.

MEXICO—The **San Martin** mine at Sombrerete, Zacatecas, is now equipped with an up-to-date power plant, mill, shops, and facilities for a production rate of 220 tons of ore per day. The mine was acquired by **American Smelting and Refining Company** last year. Production was maintained at slightly less than the rated capacity during part of the year to permit improvements to be made in extraction methods. Ore values are principally in copper, silver, and zinc, with some minor values in lead. At Asarco's **Encantada** fluorspar operations at Agujita, Coahuila, mill capacity has been increased from 110 tons to 220 tons per day, although the ore treatment rate has not been at full capacity when market demand for acid-grade concentrate is off.



Grader-Mounted Pump Transfers Chilean Nitrate

A most unusual method is producing concentrates for Anglo-Lautaro Nitrate Company, largest nitrate company in Chile. The process involves pumping a solution of crushed nitrate ore into one of a dozen ponds, each about 360,000 square feet in area. As the sun evaporates the water, the nitrate salt concentrate settles to the bottom of the pond, much as salt is recovered in the United States. Before the evaporation is complete, however, one of the firm's Adams motor "graders" which has been modified, enters the pit to reclaim the concentrate. On the front of the machine, in place of a dozer blade or snow plow, a large auger is mounted to stir up the salt. Under the frame arch, a heavy duty electric pump has been installed. The machine pulls behind it a line of floats which serve dual purposes. Above the pond surface, they support the electric cable which carries power to the pump; below the surface, they carry a flexible hose which runs from the machine back to the nitrate processing plant on shore. In operation, the machine works like a giant vacuum cleaner. As the auger stirs the heavy salt solution, the pump sucks it in and forces it back to the processing plant through the hose.

INTERNATIONAL

EUROPE

London Mining Symposium To Be Held in July

The Institution of Mining Engineers will hold an international symposium on shaft sinking and tunnelling from July 15 to 17 at Olympia, London. Concurrent with this event, a comprehensive display of mining machinery will be exhibited by the Council of Underground Machinery Manufacturers, from July 9 to 18.

Stanley Kimball, vice president of Henry J. Kaiser Company's Heavy Construction Division, will represent the United States at the symposium with a paper on tunnelling in the U.S.A. Other countries to be represented by speakers are Australia, Canada, France, Germany, Great Britain, Holland, Poland, Sweden, South Africa, and Russia. G. T. Mankovsky of the U.S.S.R. Institute of Mining of the Academy of Sciences will submit a paper on theoretical fundamentals of shaft sinking by the freezing method. Sir James Bowman, chairman of the National Coal Board, will open the symposium.

UNITED KINGDOM—Exploratory development being carried out at **South Crofty Ltd.** has been very satisfactory, and has now confirmed the existence of important ore bodies in the new Northern Lodes. Also on No. 3A and 3B Lodes, a wide ore body is in the course of being explored with good results. For the first time in two years, the production side of the operation is showing a profit.

SPAIN—With the completion of crushing installations and construction of mineral storage deposits, the North Lode open pit of the **Tharsis** and **Calanas** pyrite mines in Huelva, owned by **Tharsis Sulphur & Copper Co. Ltd.**, is now approaching the production stage. At the Center Lode, the removal of overburden was carried out throughout last year, and it is expected that some ore should be produced before the end of the year.

WEST GERMANY—The large iron ore deposit discovered recently in northwest Germany, in the Staffhorst-Brebber-Graue area about 30 miles south of Bremen, is now estimated to contain 400,000,000 tons of 42 to 48 percent ore. Depths of the deposit are between 2,400 and 3,600 feet. Two mining companies are investigating the development possibilities—**Barbara-Erzbergbau A.G.** of Dusseldorf, and **Harz-Lahn-Bergbau A.S.** of Bad Harzburg.

UNITED KINGDOM—A £2,000,000 extension to its titanium pigment plant at Grimsby has been completed by **British Titan Products Ltd.** Total annual capacity will now be 70,000 tons. Included in the project is an ilmenite preparation plant and a digestor unit with an output of 50 tons of TiO_2 per day. To cope with this capacity, a sulphuric acid plant capable of producing 180 tons daily has been included in the unit, together with auxiliary power substations and air compressors.

SWEDEN—**Boliden Mining Company** has announced that it has a total of 63,000,000 tons of lead-zinc-copper sul-

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phide ore reserves contained in three districts. In the Skelleftea district, the **Boliden, Langsele, Renstrom, Kristineberg, Ravliden, Adak-Lindskold, Brannmyran, Rudtjebacken Ostra Hogkulla,** and **Langdal** mines contain 26,400,000 tons. The **Laisvall, Lovstrand,** and **Vassbo** mines contain 31,000,000 tons, and the central Swedish group, consisting of **Garpenberg, Kalvbacken, Svardsjo, Saxberget,** and **Ljusnarsberg** mines, contain about 5,600,000 tons. Active development is taking place in the Langsele where the shaft is already down to the 430-meter level to serve as a transport tunnel to Boliden. The Adak-Lindskold has small deposits but they are rich in copper. The Brannmyran is under development. The Laisvall is the largest lead mine in the group. It contains 28,000,000 tons of 4.5 percent Pb, and it is 10 to 21 meters thick. Prospecting is underway at the mines in central Sweden.

LUXEMBOURG—Iron ore production declined in 1958, after a steady rise over the previous three years. It dropped to 6,637,998 tons, compared with 7,843,100 tons in 1957, 7,593,900 tons in 1956 and 7,204,605 in 1955. The drop is attributed to a lessening of exports, and a decline in domestic consumption.

GREECE—**Kennecott Copper Corporation** is still considering whether to develop its asbestos property in Greece by itself, or with the help of a partner. Once the project is underway, it will still take about two years before production will be forthcoming.

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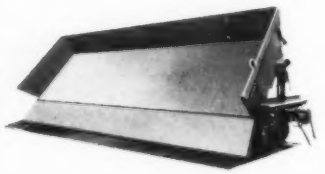

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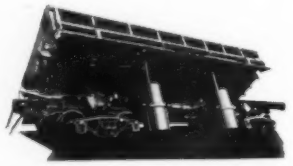

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SPAIN—A company has been formed with Spanish and American capital to develop iron ore mines near Albarracin. The new firm hopes to "reach a capacity of 300 tons of iron ore per day soon." Another new firm is **Minera de Covadonga** which will concentrate its efforts on copper mines and mineral dumps.

U.S.S.R.—The Soviet news agency "Tass", reports that Russia is developing a huge iron ore deposit in the Krivoi Rog Basin of the southern Ukraine. According to the report, the mine will go into production in 1961 with an output of 7,400,000 tons of ore annually.

NORWAY—In the Grong district, **Joma Mines (Joma Bergverk A/S)** is driving an adit to the pyrite ore body. Exploration of the ore zone will start later this year when the firm expects to reach the area. Geophysical and geological examinations in this pyrite district will also continue to be made.

YUGOSLAVIA—The Vice President, Alexander Rankovic, is reported to have told Parliament that uranium had been discovered in Yugoslavia and that development work was under way. The Parliament then approved a law on protection from radiation.

MALAYA—Leaders of the tin mining industry are jubilant over the increase made by the **International Tin Council.** In the third quarter, tin export quotas are rising from 23,000 tons to 25,000 tons. To Malaya, this is expected to mean 812.5 tons more from July to September than the present quota of 8,625 tons. Miners are now looking forward to the time when they have completed paying their contribution to the buffer stock. This is expected to be likely in September.

JAPAN—The Japanese steel mission to India has reported to the Indian government its interest in buying 4,000,000 tons of iron ore from India per year, starting in 1966. This is exclusive of other purchasing contracts and refers to ore from the Bailadela area in Bastar district of Madhya Pradesh. A survey for the development of a railway between the deposit areas and Vishakapatnam port has since been completed. Japan is anxious to import 8,000,000 tons of ore annually from India for the next seven years.

IRAN—A joint company, formed by the **Plan Organization** and **Forumad Chromite Mining Company,** is developing chromite mines in the area of Forumad in northeastern Iran. The Plan Organization hold 51 percent of the shares in the new company. According to the arrangements, the company is to produce a minimum of 12,500 metric tons of chromite annually. Ore reserves in the mines, considered to be the second most important chromite deposits in Iran, are estimated at about 300,000 metric tons.

INDIA—Drilling will be undertaken soon at the Tiruchengode area and in the Suryamalai Hills in Salem district of Madras State. The government of India will conduct the work in an attempt to assess the quality and quantity of uranium-bearing rocks. The estimated ura-

nium reserves in India at present are over 30,000 tons. Reserves of thorium are estimated at about 500,000 tons, found in the monazite sands on the west coast and in Bihar.

JAPAN—The three large aluminum producing companies in Japan are reportedly importing 60,000 tons of bauxite from **Sematan Bauxite Ltd.**, operating in the Lundu district of Sarawak, during July through September. This is in addition to 90,000 tons of Ramnia bauxite. Bauxite imports for the fiscal year ended April 30 were about 800,000 tons.

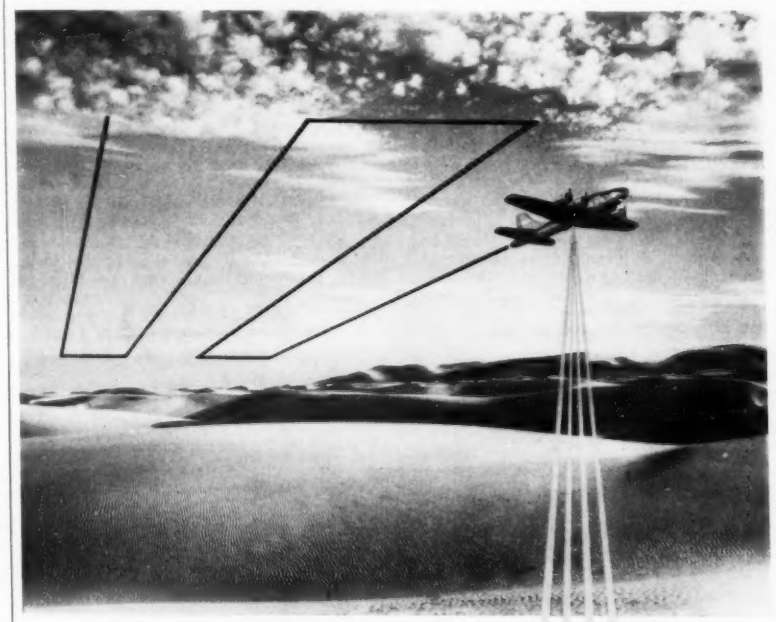
BURMA—Because of the heavy slump in tungsten prices, mine owners have been concentrating on tin production. There is a ready cash sale for tin concentrates sent to Penang tin smelters by a steamer which calls at Tavoy every three weeks. Part of the tin exported comes from deposits containing only tin, and part from electro-magnetic separation of mixed tin-tungsten concentrates. The supply of mixed concentrates is gradually diminishing, but that from the tin deposits has greatly increased.

KOREA—Of more than 20 copper mines in Korea, 12, or over 60 percent, are idle while others are operating on a limited basis because of the decreasing demand for copper ore. Thus measures to develop the copper industry are urgently required. However, end users of copper are requesting an embargo on the exportation of copper. Moreover, a movement to import copper with aid funds is causing indignation among the authorities concerned. The domestic copper mines are capable of producing 4,000 tons of copper ore annually but only eight are in operation because of limited markets and high production costs. The Changhang Refinery, the only copper refinery in Korea, is capable of processing 80,000 tons of copper ore annually but is processing only about 500 tons due to the inadequate supply of ore. The Ministry of Commerce and Industry, therefore, has, been granting large subsidies for the operation of the refinery. A certain electric wire manufacturing company is requesting an embargo on the exportation of electrolytic copper on the grounds that it requires about 3,000 tons of electrolytic copper annually and, furthermore, plans to import the items with aid funds. Reports have it also that the copper end users are planning to net an annual profit of HW 900,000,000. Officials of the Ministry of Commerce and Industry announced in this connection that an embargo on the exportation of electrolytic copper will not be considered, stressing that measures to enable copper mines to resume operations are urgently required.

BURMA—The **Mineral Resources Development Corporation** which was established in 1953 to survey, develop, and market the country's minerals, has ceased to exist as a corporate body. It has been merged with the **Industrial Development Corporation** (IDC). The MRDC functioned under a director-general and a board of directors composed mostly of the country's Ministers. In its first year, it had taken up 23 projects scheduled in a four-year plan, including exploration and surveying jobs with some foreign experts. By the end of the year, it had nine of these projects under development. These including prospecting for iron, copper, zinc, silver, lead, and coal. The **Ratanoban** wolframite mine in Mergui and the **Launghkeng** zinc mine near Taunggyi were among their greatest activities and all are now closed down.

LIBERIA—**Bethlehem Steel Corporation** has joined with **Liberian-American-Swedish Minerals Company (Lamco)** in development of the **Mount Nimba** iron ore deposit in Liberia. The government has approved the agreement. The Nimba deposit is estimated to contain about 200,000,000 tons of iron ore with an average grade of 65.5 percent Fe. Substantial reserves also exist at **South Nimba** and at **Mount Gbahm.** Lamco has been a joint venture of the Swedish firm of **Grangesberg A.B.**, the Liberian government, **International African-American Corporation, Atlas Copco, Nordstroms Linbanor, Svenska Entreprenad A.B., Skanska Cement A.B.**, and **Ifoverken.** It is believed that the **Swedish Lamco Syndicate** will be named manager of development work, with immediate responsibility directed to Grangesberg.

UNION OF SOUTH AFRICA—**Transvaal Gold Mining Estates** will erect a pyrite roasting, sulphuric acid, and superphosphate plant in the Eastern Transvaal. Phosphate concentrates will be purchased



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from the **Phosphate Development Corporation** at Phalaborwa, in the northeastern Transvaal, and will be converted into superphosphate at the production rate of 10,000 tons annually.

NIGERIA—A two-year study is being made of rocks on the Jos Plateau to investigate the distribution of tin, columbium, rare earths, and radioactive minerals. A team of geochemists from London's **Imperial College of Science and Technology** is undertaking the project for the Nigerian Ministry of Lagos Affairs, Mines and Power.

EGYPT—Some small shipments of sulphur are being made from the mines at Gemsa on the Red Sea coast. Equipment for a milling plant is being imported from England, and it is hoped that production will start from there in 1960 at a rate of 20,000 tons annually.

UNION OF SOUTH AFRICA—**Winkelhaak Mines Ltd.** believes that its shaft system is capable of hoisting sufficient tonnage to increase gold plant output to 90,000 tons per month. Therefore, it will install an additional mill and equipment for hydroclone classification. The extension is to be completed by mid-1960. In the first quarter of this year, the firm milled an average of 68,670 tons monthly, and in April this increased to 74,000 tons. In time, the firm also plans to open up the deeper levels of the mine through additional shafts.

LIBERIA—**Liberia Mining Company** has erected a beneficiation plant at its **Bomi Hills** iron ore deposit. The plant will concentrate medium- and low-grade iron ore to yield an additional 1,000,000 tons per year.

FEDERATION OF RHODESIA & NYASALAND—A number of exclusive prospecting permits were granted last year for two- and three-year periods. Among them, **Umniati Exploration,** 130 square miles in the Hartley district, for all precious metals and base minerals; **Rhodesian Selection Trust Exploration Ltd.,** 12.5 square miles in the Salisbury district, for copper; **Bindura Nickel Co. (Pvt.) Ltd.,** 24.3 square miles in the Salisbury area, for nickel; **Rio Tinto (S.R.) Ltd.,** 9.5 square miles in the Hartley district, for precious metals; **Rhodesian Selection Trust Exploration Ltd.,** 146 square miles in the Salisbury district for copper; **Messina (Transvaal) Development Co. Ltd.,** 43.5 and 19.8 square miles in the Salisbury district, and 49.4 square miles in the Hartley and Salisbury districts, for all precious metals and minerals; **M.T.D. (Sanyati) Ltd.,** 46.4 square miles in Hartley and Salisbury districts, for all precious metals and base minerals.

NIGERIA—The Nigerian government has opened a new Mining School at Jos to provide facilities for training mine managers in the latest techniques, using the latest types of ore dressing machinery. The school will also provide ore dressing services for small mine operators at a reasonable charge, and will undertake research into practical ore dressing of new mining products.

UNION OF SOUTH AFRICA—**Associated Manganese Mines of South Africa Ltd.** has commissioned one new mine for production and a second is nearing the production stage. These mines have been established principally to supply ore to **Feralloys Ltd.** in Natal, where the first two ferromanganese furnaces will be commissioned in the near future. The company has purchased the mineral rights for an additional 8,453 acres, over which leases were previously held. Exploratory operations have continued.

EGYPT—Four large iron ore deposits are reported to have been found in the eastern desert and a number of German firms are said to have applied for the right to develop them. Among the contenders is **Krupp Corporation,** which had sent a geological crew to Egypt to prospect for mineral resources at the government's request and which actually made the ore discoveries.

BELGIAN CONGO—Three ACEC Koepe hoists have been installed in the **Prince Leopold** copper-zinc mine of **Union Miniere du Haut Katanga.** Two of the machines, with skip and counterweight, are designed for automatic or manual operation, and will be used to hoist to the surface up to 52 skips per hour. The third machine, with cage and counterweight, will have the same general characteristics of the other two but will be manually controlled because it will carry personnel as well as equipment and ore. All three will have all of the improvements brought about by magnetic amplifiers, that is, precise regulation, control of positive and negative acceleration, and torque limitation.

NIGERIA—The Nigerian government has discussed with the Atomic Energy Division of the **Geological Survey of Great Britain** the possibility of undertaking a survey for radioactive minerals in the western region of Nigeria. As a result, J. Taylor, a British scientist, has been assigned to do this work.

UNION OF SOUTH AFRICA—At an estimated cost of £7,100,000, **Zandpan Gold Mining Company** will complete its No. 1 shaft in the south central section, provide necessary services and facilities, and advance a certain footage of underground (including reef) development. Further capital will then be raised for the sinking of a second shaft system at a site, which will be determined by disclosures in the No. 1 shaft area and drilling; for the erection of a gold plant; and for providing housing, services, and other facilities to bring the mine to the initial stages of production. The layout of the No. 1 shaft has been modified. It will be sunk as an unbroken vertical shaft from surface to the Vaal Reef horizon at a depth of 7,000 feet below the surface. This will facilitate an earlier start of exploratory development than would have been possible if the shaft were sunk in two sections as originally planned.

FEDERATION OF RHODESIA & NYASALAND—A plan has been devised by Sir Frederick Leggett to prevent strikes of European employees in the Rhodesian Copperbelt and although details of this plan have not been revealed publicly it is understood that three major innovations are being incorporated. 1. Senior supervisors are to be given more authority to deal with disputes and complaints. 2. Three-day "cooling off" periods will be included in negotiating machinery to prevent minor troubles from turning into major disputes. 3. A joint council of six mine-owners and six union representatives will be set up to deal with serious matters affecting the whole industry.

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Mt. Isa To Double Copper Smelting To 80,000 Tons

Mt. Isa Mines Limited has started a major copper smelting expansion program at its mine in Queensland, Australia. The enlarged smelter will have an annual output of 80,000 tons of blister copper. The new electrolytic copper refinery at Townsville will also be enlarged from 40,000 to 60,000 annual ton capacity. G. R. Fisher, chairman, reports that it will take 18 months for smelter expansion at a cost of £A 3,750,000. American Smelting and Refining Company, largest shareholder in Mt. Isa recently announced that both lead and zinc output will be curtailed. Copper ore is mined separately, but from adjacent ore bodies to the lead-zinc ore so there will be no problem to expand copper ore output while curtailing lead-zinc mining.

QUEENSLAND—A new firm has been organized to develop uranium deposits in the Mary Kathleen area. Known as **Queensland Mines Ltd.**, 51 percent of its stock is owned by **Factors Ltd.** of Melbourne, and **Australasian Oil Exploration Ltd.**, a subsidiary of **Mary Kathleen Inventments Ltd.**, holds the remainder. The most important deposit held by the firm is **Anderson's lode,** 11 miles east of Mt. Isa. Ore reserves shown so far by diamond drilling are 800,000 tons. Drilling is continuing and there is no indication that the ore body will not continue to develop. Another deposit, the **Skal,** 26 miles from Mt. Isa, is estimated to contain 200,000 tons at this stage. If a satisfactory sales contract can be arranged, Factors Ltd. will finance construction of a treatment plant.

WESTERN AUSTRALIA — **Hill 50 Gold Mine N.L.** at Mount Magnet has discovered an ore body estimated to contain 8.5 dwts per short ton and 82 tons per vertical foot. This grade is a little below present values (about 10 dwts) but indications are that the mine in not petering out in the lower levels as some reports have hinted. In the fiscal year to April 14, 1959, Hill 50 had treated 131,761 tons for a recovery of 62,516 ounces of gold.

AUSTRALIA—The Federal government will continue its Gold Mining Industry Assistance Act which would have expired on June 30. The subsidy payable will be increased from £2/15/ per ounce to £3/5/ per ounce for major producers and from £2 to £2/8/ for smaller producers. These increases will be barely sufficient to keep the marginal mines alive. The sulphuric acid bounty system is being extended for another year, and the government has indicated it will look after the companies which cooperated with it several years ago by installing plants to use pyrites.

SOUTH AUSTRALIA—The **South Australian Mines Department,** which has been in the forefront of developments designed to foster mining within the state's boundaries, has sent officers to Sweden to study taconite operations. There are large taconite deposits in the

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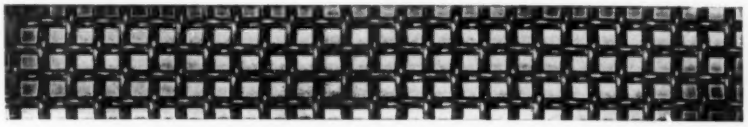

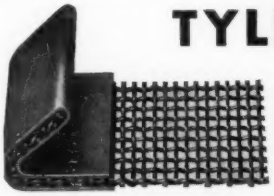

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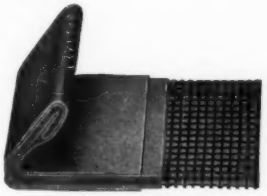

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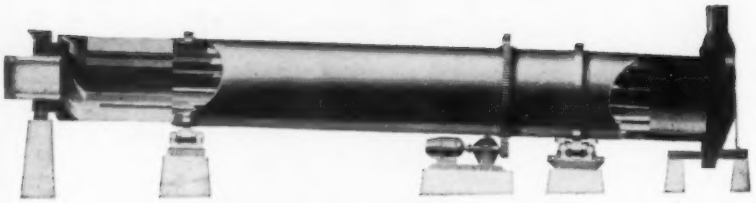

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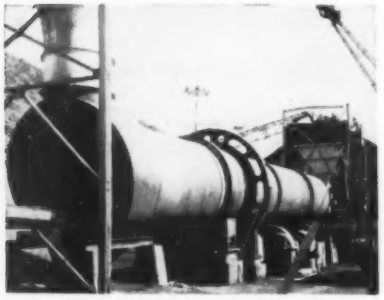
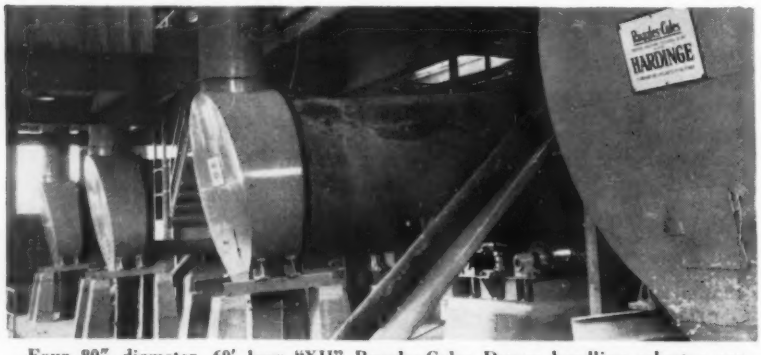


10′ diameter, 80′ long "XH" Ruggles-Coles Dryer drying bauxite in Jamaica.



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Middleback Range, whereas reserves of high-grade hematite are considered limited. The Australian iron and steel industry has been fortunate to have clean, high-grade ore to treat during its formative years, but it is inevitable that lower grade ores must be used in years to come.

REPUBLIC OF THE PHILIPPINES—Arrangements have been made for **Philippine Iron Mines** to send 20,000 dry metric tons of shipping grade iron ore to Japan over the next 12 months. The ore will actually come from the **Lobo** property of **M. Venida & Company, Inc. (MARAVENI)** in Camarines Norte. The property is estimated by Japanese geologists to contain over 500,000 metric tons of high-grade hematite. Philippine Iron is handling the shipments because it has an export arrangement with the Japanese buyers.

NORTHERN TERRITORY—**Mount Harris Tin Mines N.L.** is carrying out a trenching program on the **Jessop** and **Mount Harris** leases. Five trenches will be opened over a length of 1,000 feet to test for faulting, parallel lodes, and an echelon structures. The **Bureau of Mineral Resources** has been asked to diamond drill the Jessop Lode.

NEW GUINEA—Production figures for the quarter ended February 28, 1959 show that **Bulolo Gold Dredging Ltd.** is now working in higher grade ground. Although yardage dredged and sluiced in this quarter was down—917,305 yards, compared with 1,198,500 in the same period of 1958, recovery was improved. In this period of 1959, recovery totaled 4,274 ounces of fine gold, compared with 3,209 in 1958. Value per yard was 16.30¢ in 1959 and 9.37¢ in 1958. For the nine-month quarter ended February 28, the company dredged and sluiced 3,702,005 yards to recover 15,442 ounces fine gold, compared with 4,273,900 yards to recover 20,524 ounces in the same period of 1958.

REPUBLIC OF THE PHILLIPINES—**Lepanto Consolidated Mining Company** has acquired a potential gold placer area in Mindanao near Davao and is undertaking preliminary testing of the ground. Test drilling of another Mindanao gold placer area last year proved too low in values to justify a dredge and so the operating contract was cancelled. The company's copper mine in Lepanto, Mountain Province, has substantial ore reserves, and the company is continuing to seek other promising properties.

WESTERN AUSTRALIA—**Kalgoorie Southern Gold Mines** is ready to resume deep drilling in its search for a southward extension or repetition of the main Kalgoorlie ore deposits (the "Golden Mile"). Nine holes have already been drilled to depths between 1,000 and 6,000 feet. Present objectives are below 6,000 feet and will be the deepest holes drilled in Australia.

REPUBLIC OF THE PHILLIPPINES—A new ball mill has been installed by **Benguet Exploration Inc.** The firm now looks forward to uninterrupted milling operations without the previous frequent prolonged costly shutdowns. Meanwhile, development worg has been progressing normally and satisfactorily at the firm's Thanksgiving property.

INDONESIA—An estimated 22,000 tons of tin were produced in Indonesia during 1958. There has been a steady decrease over the last few years . . . from 30,053 in 1956 to 27,725 tons in 1957, and the present 22,000.

B.C. Chamber of Mines In New Headquarters

Lodged for the first time in permanent quarters of its own, the British Columbia & Yukon Chamber of Mines has moved into its newly purchased, two-story building at 840 West Hastings Street, in the heart of downtown Vancouver. The Chamber's new location, strategically, is near the local branch of the Provincial Government Department of Mines and the Geological Survey of Canada.

The Chamber of Mines, established in 1912, is the oldest organization of its kind in Western Canada. Its founders recognized early that Vancouver would be the center of the province's mining industry and that mining would become one of its important industries. From the start the Chamber has fulfilled its original purpose as a clearing-house for mining people's problems and a contact point between exploration companies and owners of mining property. With the industry's growth through the years, the organization has expanded its services to meet the needs and protect the interests of prospectors and mining people generally.

In the development of Canada's northland, the Chamber of Mines has used its influence to promote the building of more roads, railroads and air routes. It has worked hard for the establishment of fair mining legislation to encourage foreign prospecting activity and investment in Western Canada. For 41 years it has conducted prospectors' training classes. Chamber officials state that over 3,500 men have been trained in prospecting. This year a special series of lectures in geophysical prospecting has been added to the program, in conjunction with the Physics Department of the University of British Columbia.

Among its numerous services, the Chamber of Mines has long provided a means of contact between the mining industry and business and supply firms dealing with the industry. Chamber officials emphasize that through their efforts many manufacturing industries have come to the area, to the extent that now all materials for mining development and prospecting can be purchased in this area. The Chamber also helps men looking for jobs in the mines and publishes yearly an employment list of addresses of operating companies and employment offices.

The Chamber's new premises house not only the offices of the organization but also its valuable mining library, its files of information on mineral occurrences, markets and mining developments, and a showroom for ore exhibits. A new feature is the private meeting room, available without cost to all mining people visiting Vancouver.

Now established in its first permanent home in 47 years, the organization will continue to play its important role in the development of Western Canada's mineral resources. Heading the Chamber's Executive Committee are Dr. Christopher Riley, president, and vice presidents R. E. Legg and G. A. Dirom. Thomas Elliott is Manager.

ALASKA—**Sunshine Mining Company** expects to examine its copper prospect in southeastern Alaska this season. The occurrence was found last summer during the course of a geological reconnaissance. The general aerial reconnaissance will also continue this summer.

MANITOBA—**San Antonio Gold Mines** is going ahead with development of the deep gold ore body indicated by drilling on the adjoining property of its subsidiary, **Forty-Four Mines Ltd.** A winze will be sunk to a depth of at least 1,000 feet

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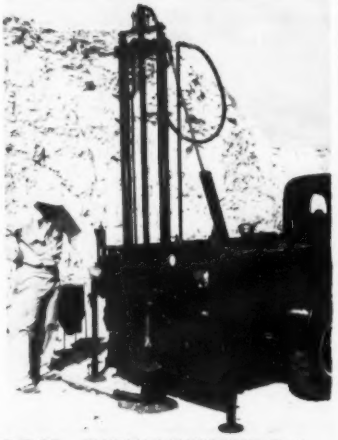

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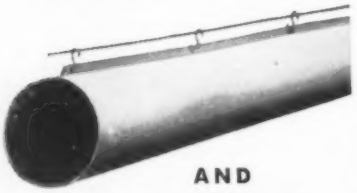

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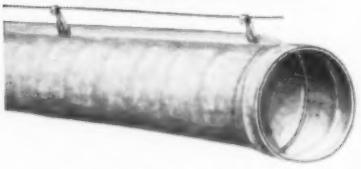

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below the 26 or bottom level (3,864 feet), and six to ten levels will be opened. Driving of main haulage way to the site of the No. 5 winze has already started.

BRITISH COLUMBIA – **American Metal Climax Inc.** is now exploring its 103-claim molybdenum property at greater depth in the Clinton mining division. Called the **Boss Mountain** property, the area was acquired by American Metal Climax in September of 1955 and some 20,000 feet of drilling has been achieved. The work has indicated about 1,250,000 tons averaging 0.74 percent MoS_2, together with a possible 3,000,000 tons of 0.35 percent MoS_2 grade. Heavy equipment has been moved in to handle the deeper drilling.

QUEBEC–**Beauce Placer Mining Company** has made a down payment on a 6-cubic-yard dredge and hopes to have it in operation on Gilbert River, about 50 miles south of Quebec City, by late summer or early fall. Exploration is continuing. Values found over an area about 22,000 feet in length gave a potential yardage of about 21,000,000 cubic yards. Elimination of one section which presents some operating problems would still leave about 16,000,000 cubic yards of proven and indicated ground.

ONTARIO–Present contracts providing for sales of uranium precipitates produced by **Algom Uranium Mines** and **Pronto Uranium Mines** to **Eldorado Mining & Refining Ltd.** have been extended. Pronto's contract would have expired about December 1960, and in September 1961 for Algom. The new additions will enable these firms to produce at their current rates until March 31, 1962. Algom will deliver approximately 2,500,000 pounds of U_3O_8 valued at $20,000,000 and Pronto will deliver an additional 1,500,000 pounds valued at $12,000,000. The price per pound under the terms of the additional contracts is $8.00. The contracts also give Eldorado options on output of the mines up to December 31, 1966. Both firms are part of the **Rio Tinto Company of Canada**, and operate in the Elliot Lake district.

ALASKA–Lode gold mining is being revived in northern Alaska's Chandalar mining district. **Little Squaw Mining Company** of Spokane, Washington has leased the old **Mikado** mine and other properties and moved in a 28-foot trailer house, air compressor, mucking machine, and other equipment by plane. The supplies were unloaded on the ice of Lake Chandalar and hauled over eight miles of frozen tundra by Diesel-powered bulldozer. Plans call for driving a 100-foot raise from the 500-foot adit to the bottom of an ice-filled shaft where high gold assays were taken years ago. Drifting will then be undertaken to determine what size mill is justified. If a concentrator is installed, it will be the district's first. Early-day operators had to haul in all supplies by dog sled from Beaver on the Yukon River, a rugged 125 miles. Frank Birch, Spokane mining engineer, has taken a contract for the development work. Little Squaw Mining company is a recently organized subsidiary of **Grandview Mines, Inc.** and **Metaline Mining and Leasing Company** of Spokane. Karl W. Jasper is president of all three firms. Eskil Anderson, mining engineer and geologist for Grandview, is vice president and general manager of the new operating company.

NORTHWEST TERRITORIES – **Indian Mountain Metal Mines Ltd.**, which holds a 33-claim base metal property in the Indian Mountain Lake area about 120 miles east of Yellowknife, has purchased a major share of the capital stock of **Gui-Por Uranium Mine & Metals Ltd.** Included in the transaction is management and control of Gui-Por's affairs and activities. Indian Mountain recently staked a 70-claims group in the copper-gold belt of Chibougamau, Quebec, and plans to examine the property shortly. It has also acquired by staking a group of claims on strike of a recent copper-nickel discovery in the Northwest Territories. The firm's original group in the Indian Mountain Lake area will be held for a while until base metal prices improve. Drilling a few years ago had shown a 1,000,000-ton deposit in "A" zone grading about 10 percent zinc, 0.85 percent lead, and 3.5 ounces silver per ton.

QUEBEC–**Oglebay Norton Company** has sent crews in to undertake exploration of the **Roberval Mining Corporation's** iron property in Lyonne Township which it recently optioned. (See MINING WORLD, May 1959, page 87.) **Spartan Air Services** of Ottawa has already made an airborne survey of the 8,000 acres. Firm representatives have also discussed with railway officials the possibility of a 15-mile spur line from the property to the **Canadian National Railways** line.

BRITISH COLUMBIA–**Birkett Creek Mine Operators Ltd.** is preparing to drive a second adit in the **Craigmont** mine near Merritt. The company is owned 50 percent by **Canadian Exploration**, 25 percent by **Noranda Mines**, and 25 percent by **Peerless Oil and Gas Company**.

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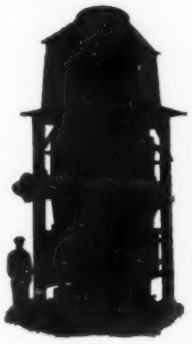

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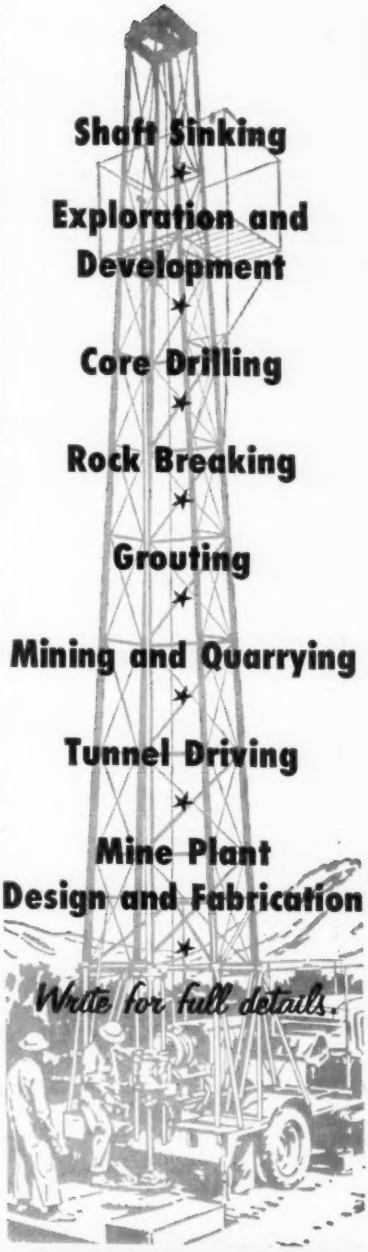

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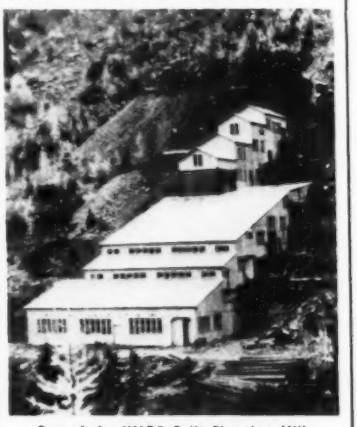

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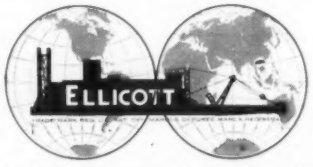

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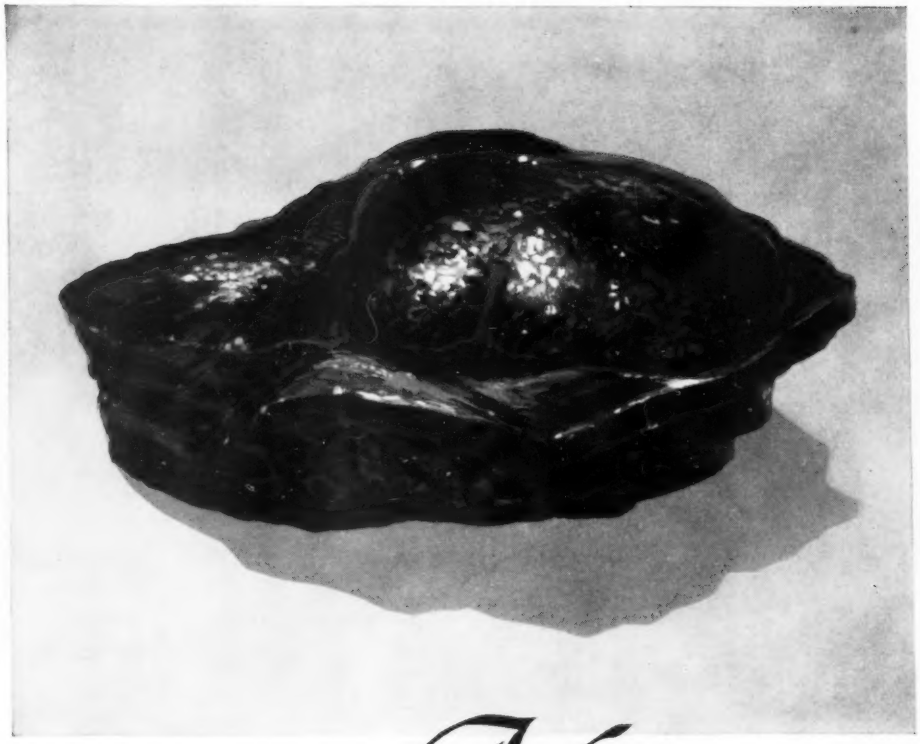

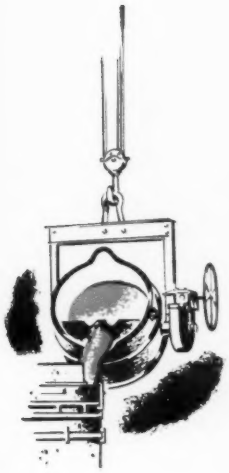

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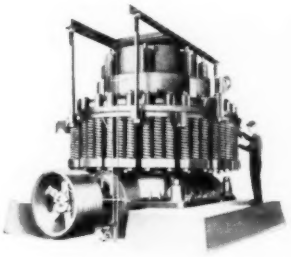

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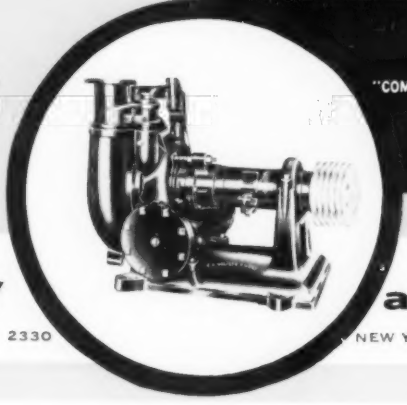

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